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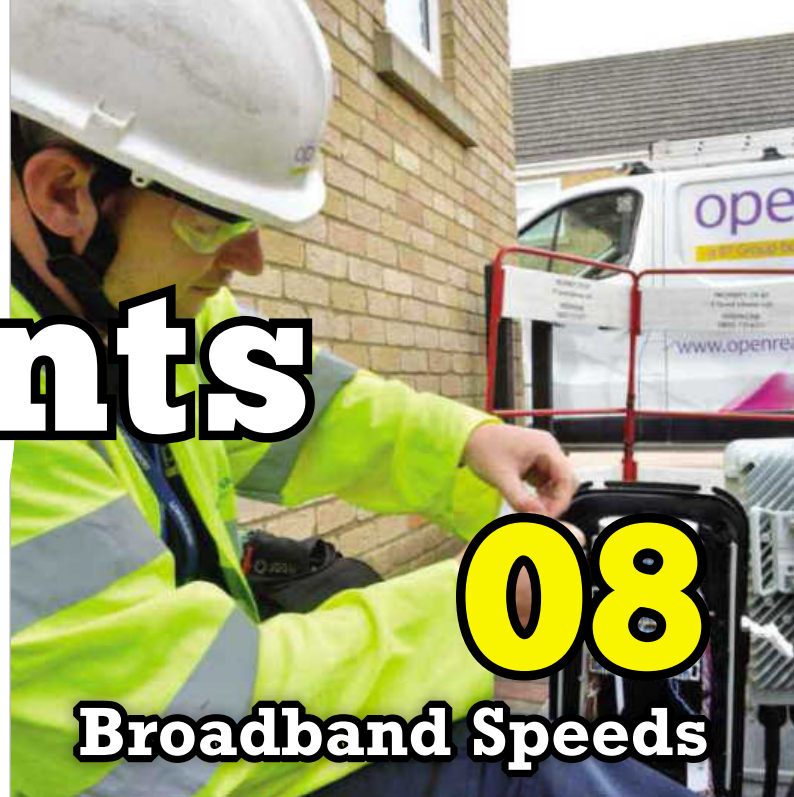
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08 Broadband Speeds

Faster broadband speeds are coming to the UK, with a few major players investing millions in the networks. Is it enough to compete with the rest of the world, though, and who will actually benefit from these faster speeds? As David Crookes has been finding out, not everyone is going to be invited to the party

18 Prebuilt Vs Self-build PCs

Even if you know how to build your own PC, there's no guarantee you actually want to. After all, buying a prebuilt system means you get a computer built by experts, and you know exactly who to turn to for support. There's always going to be a cost saving if you do it yourself, however. Mark Pickavance looks at how much that might be

50 Smartwatch Buyers' Guide

Apple's reluctance to release sales figures for the Apple Watch suggests that the smartwatch market isn't doing as well as expected. You shouldn't necessarily let that put you off buying one, though. If you have the money for a smartwatch and you'd benefit from what it has to offer, then now isn't a bad time to get one. We look at a selection of what's available so you have an idea of what to look for



Prebuilt Vs Self-build PCs



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58 Top Tips

60 Podcasting Apps

58 Top Tips

Over the last few weeks, Roland Waddilove has been sharing some advice for getting the most from Windows 10's built-in apps. This week, to round off the series, he's taking a look at the best of the rest. If you've been struggling to get to grips with Microsoft's latest OS, this could be just what you're after

60 Podcasting Apps

First, the internet democratised the written word, and then it did the same with radio. Podcasts are easy and cheap to create, and they can allow anyone to share their thoughts online. If you're looking to set your own podcast or you just want better apps to listen to those recorded by other people, these picks will be a great start

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When you buy a Raspberry Pi, there's nothing to say you have to install the official Linux distro, Raspbian. If you do, however, it's likely you want to do some coding with it. In that case, you'll need to know where to get started and which resourced to tap to make the most of your coding time. David Briddock is here to help with that, with this beginner's guide



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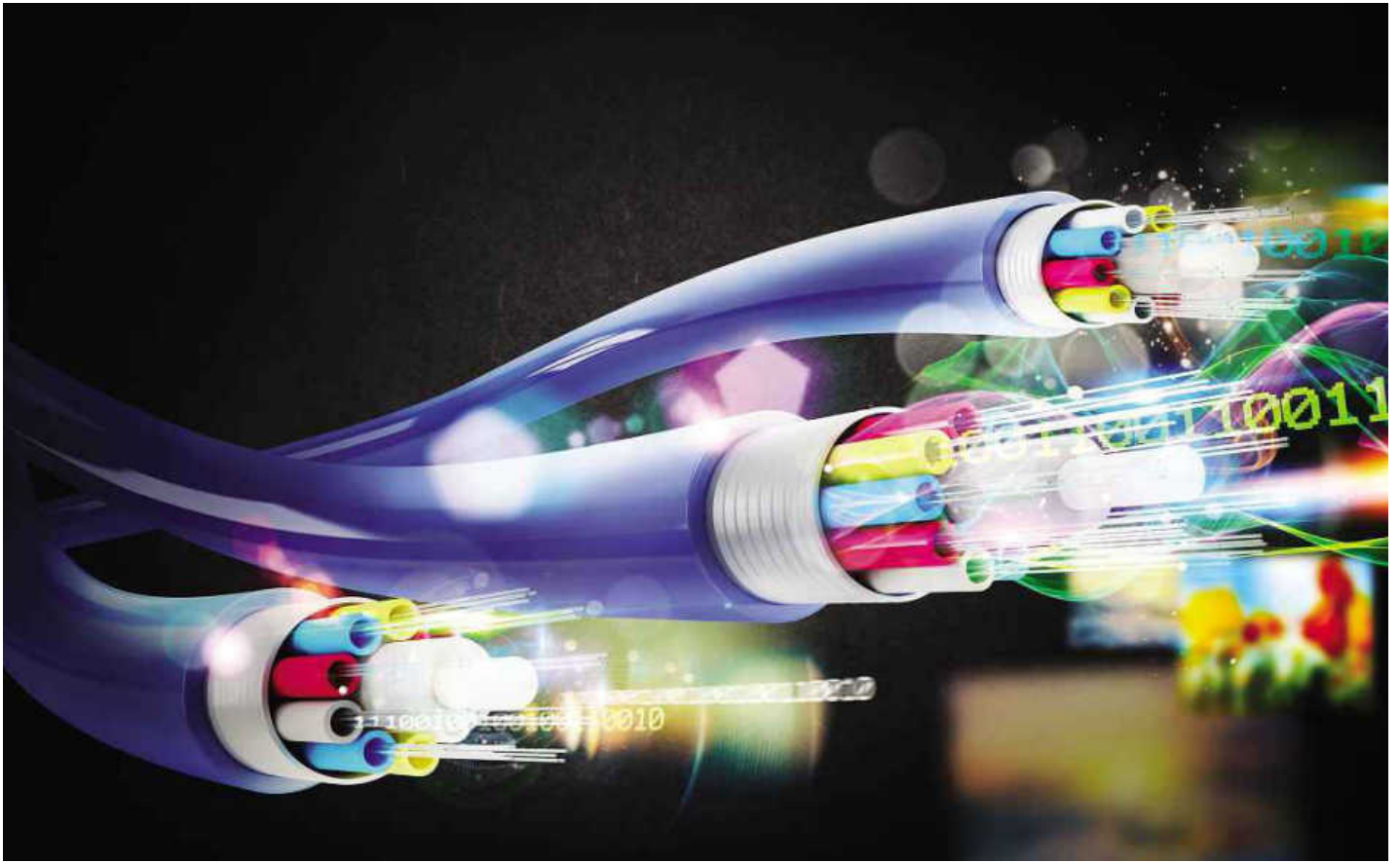
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Are We Getting Faster Broadband?

There are winners and losers in the next push for superfast broadband



The news came on election day, which is always a great time for any government to sneak something past the watchful eyes of the electorate. Unfortunately for ministers on this occasion, the people that the news concerned are very adept at spotting anything speeding past them faster than an over-excited bull, and they were able to pick up on it immediately. That's not only because they live in rural Britain, where all creatures great and small reside, but because it was about a matter they have been campaigning about for a very long time: the need for superfast broadband to be rolled out in the countryside. And what they were about to hear touched a nerve.

“ You do wonder who on earth would not want fast broadband today ”

Up until 5th May, everyone was under the impression that ministers were going ahead with their plan to deliver superfast broadband to remote areas that do not have any decent services. It was a promise Prime Minister David Cameron committed himself to, saying broadband was as essential to UK homes and businesses as gas, electricity and water. To enable this, a Universal Service Obligation promising at least 10Mbps broadband was going to be delivered, and the Countryside Alliance (CA) said that this was “good news for those who live and work in the countryside where digital connectivity has traditionally been poor or non-existent”.

But then the government performed a u-turn. Suddenly the light at the end of the tunnel was darkened. All the hopes and plans and praise vanished. It left 5% of the country – those who have been languishing behind in terms of broadband speed – speechless. Yet that turned to anger when they heard the reasoning.

According to a consultation document into the USO, the reason why superfast broadband is not being rolled out automatically is that it is unlikely that most people in remote areas will want speeds of 25Mbps “even if that option is made

available to them.” In conclusion: “We do not believe than an additional broadband roll-out programme at this time is proportionate or would represent value for money.”

So much for getting everyone up to speed by 2017. Now the roll-out is only going to happen if homes and businesses request it rather than automatically. And what's worse is that anyone hoping to enjoy the benefits of fast broadband next year will have to wait – the USO will be in place “by the end of this parliament,” the government says, which is politician speak for 2020. But what makes things worse is the new deal is very vague at the moment, both in terms of who is going to be stumping up the costs – the government or the requesters – and what hoops will have to be jumped through to get to the point of installation.

Lagging Behind

When it comes to broadband speeds, rural areas have seriously lagged behind. Although coverage for superfast broadband increased significantly in 2015 – from 22% in 2014 to 37%, reaching over 1.1 million premises, it meant around 2.4 million homes and small businesses in the UK were still unable to receive broadband speeds above 10Mbps, with 48% of these premises in rural areas.

Sarah Lee, head of policy for the Countryside Alliance, said at the time, “Industry, government and the regulator need to work together to close this digital divide if we want our rural communities and businesses to be able to engage in a digital world.”

Now the USO isn't going ahead as expected, she's still saying the same thing, but those who can actually put the plan into action aren't singing from the same hymn sheet any more. It's also odd that the Universal Service Obligation won't actually be universal unless everyone who should get it puts up their hands and slaps in a request.

The trouble seemed to surface in April when Conservative Culture Minister Ed Vaizy warned that some of the most isolated rural areas were likely to miss out on the plans for faster broadband access. Back then, he told MPs, “I'm not going to guarantee to you that every single premise is going to get 10Mbps, but it should be potentially possible.”

He blamed the delays on Broadband Delivery UK and the time it was taking for councils to negotiate contracts. But he



The Fastest Cities For Broadband In The UK

According to research by uSwitch, the fastest city for broadband speeds in the UK is Middlesbrough with 34.46Mbps, but it's bad news for Hull in East Yorkshire, which is said to be the slowest with just 12.5Mbps. It's perhaps telling that Hull is served by its own local telecommunications company, KCOM, and not only does that mean there is no rivalry, it also means that the investment made by national companies such as BT and Virgin fail to reach the city boundaries.

"Although KCOM is currently rolling out ultrafast-capable, fibre-to-the-home connections in Hull, actual speed tests taken by broadband users would suggest this hasn't reached enough homes yet to make an impact on the average," says Ewan Taylor-Gibson, broadband expert at uSwitch.com. He also pointed to the fact that only 22 cities on the list had broadband speeds of more than 24Mbps.

still said BDUK was on track to give at least 10Mbps to 95% of the country by next year, which left that other 5% dangling).


"There would be a potential cap on the amount of public funding if a particular connection will cost many thousands of pounds," he replied to a question of why not 100%. "[It is uncertain] whether it should be effectively paid for by industry and whether there should be any connectivity contribution from individual premises." The decision-making process has moved on a bit since then but with an outcome that is causing an outpouring of anger.

"A successful and vibrant countryside is dependent on being able to compete economically and socially with urban neighbours," Lee wrote in the Daily Telegraph after the about-turn from the government. "Without this ability to compete, rural communities and landscapes we know today will change rapidly. They will wither."

Faced with that kind of stark warning, you do wonder who on earth would not want fast broadband today when so much depends on a good, solid, dependable and speedy network. More and more of our business is conducted online. We're entertained online. A lot of government admin is done online to save you the bother of calling anyone and speaking to them in person.

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To those in urban areas access to superfast broadband and 4G mobile phone coverage are readily available and in recent years have become basic amenities in the same way as water and electricity. In the countryside they are just as essential but nowhere near as available. Both broadband and mobile coverage are patchy and can be unreliable, making life for families and businesses alike very difficult. Life in a digital age does not yet extend to the countryside, and we are working hard to change that, lobbying government and working with communications companies to ensure roll out.

Rank	UK City/Town	Average Download Speed (Mbps) 9 Aug 2015 to 8 Feb 2016
1	Middlesbrough	34.46
2	Belfast	34.34
3	Brighton	33.80
4	Swindon	31.83
5	Nottingham	30.43
6	Cardiff	30.23
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8	Huddersfield	27.71
9	Plymouth	27.33
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17	Wigan	25.52
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32	York	21.29
33	Newport	21.24
34	Newcastle	21.14
35	Edinburgh	21.07
36	Norwich	19.43
37	Doncaster	18.38
38	Sheffield	18.36
39	Wakefield	17.49
40	Milton Keynes	17.10
41	Aberdeen	15.67
42	Hull	12.42

So what's happened? Most likely the government has looked at the figures required to achieve this dream and thought, "Hang on a second, this is looking rather pricey," and decided that it should only give it to those who plead and beg and say please over and over. This isn't the line from

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the Department for Culture, Media and Sport, which said, "It's absolute nonsense to suggest we're leaving rural areas behind in our roll-out of broadband. Our current plans will reach at least 95% of the UK, but we want everyone to have fast broadband, so we are introducing a Universal Service Obligation to help make sure no one is left behind." And yet so many people feel they are on that hard shoulder of the information superhighway that has been with most of us since the mid-1990s.

“ Virgin is hoping to provide an alternative to aging copper telephony-based network ”

£6bn BT Investment

What makes the timing even stranger, though, is that this announcement came on the day BT issued a press release of its own. In it, BT said its ambition was for ultrafast broadband to pass 12 million premises by 2020, helping the UK remain at the forefront of the countries that make up the G20 group with the largest take-up of them all. BT says more than 90% of UK premises can access superfast broadband across all fixed networks right now, and that is set to rise to 95% by the end of 2017.

But will that include a lot of rural premises? It's unlikely. What this does, in effect, is prevent those in the countryside from having the same opportunities that apply to everyone in the UK. At a time when the internet is important for business in the UK (12% of our GDP comes from online business), that's more than a bit of a blow for both sides.

BT's investment is considerable, though. It's two arms, Openreach and EE, will between them pump in a whopping

How Much Are We Paying?

We may – or, for some people, may not – be getting superfast broadband, but we will soon know exactly what we are going to be paying and what we are looking to get when we fork out for broadband.

The Advertising Standards Authority (ASA) wants a change to the way broadband prices are marketed and says that companies will have to advertise a single-figure monthly cost for their broadband packages.

Coming into force on 31st October 2016, broadband adverts will need to show all-inclusive up-front and monthly costs, with no more separating out of the line rental, and give greater prominence for the contract length and any post-discount pricing. It also wants adverts to give greater prominence for up-front costs.

It followed research conducted with Ofcom, which showed that many consumers felt confused when trying to calculate the true cost of a contract. They didn't want to be bombarded with introductory offers, line rental costs, contract lengths and one-off costs. Indeed, figures by the ASA show only 23% of participants could correctly identify the total cost per month after the first viewing of the ad.

"We recognise the importance of broadband services to people's lives at work and at home. The findings of our research, and other factors we took into account, showed the way prices have been presented in broadband ads is likely to confuse and mislead customers," said chief executive of the ASA Guy Parker.

"This new tougher approach has been developed to make sure consumers are not misled and get the information they need to make well-informed choices. We'll support the broadband industry as they move towards changing their approach in time for the October 31 deadline."

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£6 billion over the next three years to make their own superfast broadband commonplace for so many of us, proving if nothing else that installing superfast broadband is indeed actually quite dear.

According to BT, there will be an increased focus on fibre to the premises (FTTP) technology, which is its high-speed broadband service between the exchange and users' premises. It already has the largest FTTP network in the UK, and it has been conducting further trials of this technology to prove it can reduce the cost of deployment. It aims to reach two million premises with the technology, mainly in new housing developments of more than 100 houses, high streets and business parks, providing them speeds of up to 1Gbps without the need for a dedicated business-grade line.

BT Openreach is also ready to go with long reach VDSL, which has been identified as a potential solution for slower broadband problems in some parts of the country. It will run technical trials over the coming months, but it says regulatory support is needed for the plans in order for them to get the green light. In any case, most of us will get ultrafast broadband via G.fast, a technology that BT says transforms the speeds customers can receive. Yet while it claims speeds of up to 300Mbps have been achieved through G-fast in tests, it's a mix of fibre and copper.

"G.fast is an important technology that will enable us to deploy ultrafast broadband at pace and to as many homes as possible. Customers want their broadband to be affordable as well as fast, and we will be able to do that using G.fast," says BT group chief executive Gavin Patterson.

Mixing fibre and copper, however, is a bone of contention for some rivals, particularly Sky. It is aghast at BT's decision to continue to use copper rather than rip it out in favour of

Sky-high WiFi

Broadband may not make it to many rural premises over the next year but, ironically, there's a good chance that it will be available in the air above them.

In a deal struck between British Airways' parent company International Airlines Group and Gogo, the internet is going to be beaming to passengers on aeroplanes flying at 30,000 feet.

Gogo is able to use satellite-based technology in order to provide speeds at up to 70Mbps for airline passengers.

It's not known what people will and won't be allowed to use (or whether or not the service will cost more than the flight itself), but theoretically we should be able to use our own devices to stream TV and music or make phone calls.

The service will be available on the Airbus A380 and the Boeing 787. Other airlines under the IAG group will also benefit including Aer Lingus and Iberia, while Delta Air and Virgin Atlantic are looking to use a different provider.

"We are delighted to bring Gogo's industry leading 2Ku technology to three of the most iconic brands in commercial aviation," said Michael Small, Gogo's president and CEO.

"One of the many benefits of 2Ku is that it's built on an open architecture and can leverage numerous Ku satellites around the world today and new advancements in the Ku-band coming online in the future. This means the technology will get even better over time and will provide passengers with a superior connectivity experience now and in the future."



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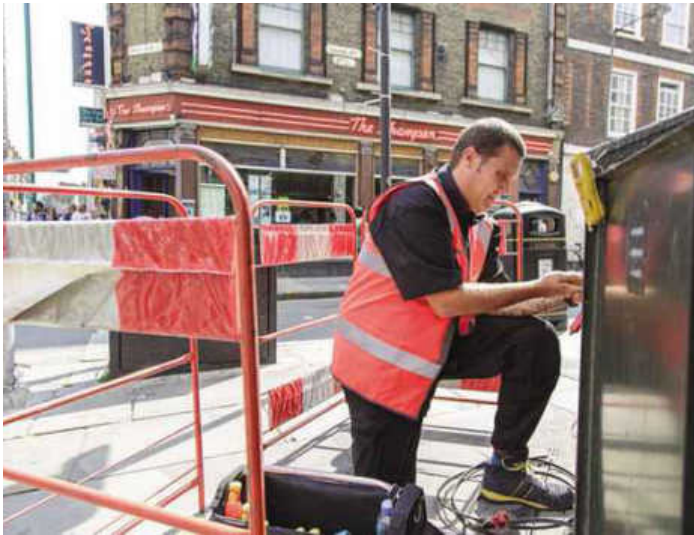
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a fully fibre connection. Already a fierce opponent of BT's infrastructure arm, Openreach remaining part of the BT group (Ofcom stopped short of ordering it be separated), Sky's chief operating officer, Andrew Griffith, said, "BT continues to see copper as the basis of its network for 21st century Britain. Despite BT's claims, it is clearer than ever that their plans for fibre to the premise (FTTP) broadband will bypass almost every existing UK home."

He added, "This limited ambition has been dragged out of BT by the threat of regulatory action, demonstrating once again why an independent Openreach, free to raise its own long-term capital, is the best way for the UK to get the fibre network it needs."

In response, BT says it remains committed to FTTP. "FTTP will play a bigger role going forward, and I believe it is particularly well suited to those businesses who may need speeds of up to 1Gbps. My ambition is to roll it out to two million premises, and our trials give me confidence we will," Patterson continued. But those figures are smaller, and the roll out of that is going to take much longer, by all accounts.

Virgin's Project Lightning

Luckily, BT is not the only network involved in boosting speeds. "Virgin and BT have both pledged to invest, and we will now see if others follow our lead," Patterson adds. "Infrastructure competition is good for the UK, and so is the current Openreach model, whereby others can piggyback on our investment should they want to."

Virgin Media is currently adding four million homes and businesses to its network as part of expansion plans it dubs 'Project Lightning'. Of those, a million will benefit from FTTP, it says. Now, this hasn't been entirely welcomed. Even though it will offer speeds of up to 200Mbps to consumers and 300Mbps for businesses by 2019 and represent an investment of some £3 billion, one councillor in York, Mark Warters, is worried about the effects it will have on his area.

"Having seen the disruptive and shoddy way these works have been carried out in the rest of York, I will not let that situation arise in this ward unchallenged," he said. "Given that [my ward] Osbaldwick is currently covered in daffodils, most of which I planted with the local scouts over the years, as well as many other parts of the ward, I most certainly

want to know which areas of verge are to be destroyed and what reinstatement/compensation plans are in place for local communities."

All of which goes to show that perhaps there are some people who don't want the benefits of superfast broadband. But what Virgin is doing, though, is making the single largest investment in the UK's broadband infrastructure in more than a decade and, together with BT, we should start to see something of a revolution in speeds in most – but not all, as we know, parts of the country.

Certainly, Virgin is hoping to provide an alternative to the aging copper telephony-based network. It is even looking to roll out a hybrid fibre coaxial (HFC) network in the UK, which combines optical fibre and coaxial cable. "Our £3bn investment to bring ultrafast connectivity to more parts of the UK is not just about better broadband, it's about future-proofing the country's network infrastructure with the best and most modern technology," says Tom Mockridge, CEO of Virgin Media.

"While some companies talk a good game, Virgin Media is putting its money where its mouth is and laying fibre to the premise, delivering the fastest widely available broadband

“ BT said its ambition was for ultrafast broadband to pass 12 million premises by 2020 ”

speeds. In just over one year, we've laid enough new cable to stretch all the way from Land's End to John O'Groats, reaching a quarter of a million more homes and businesses – and there's much more to come."

Future-proofing

Both BT and Virgin's investment sound promising, representing massive investment in our broadband infrastructure, coming at a time when the country is still falling short when it comes to offering the very best speeds. But it still leaves the little matter of the countryside which, in effect, will fall even further behind the rest of the UK. The government is unlikely to change its mind at this stage, so the only thing those in the rural communities can do is work out how to put in their requests and hope that they are listened to.

"We have worked tirelessly for many years now to bridge any kind of 'town versus country' divide, and the casually metropolitan sentiment expressed in [the consultation] document indicates why we still have an uphill struggle," says Countryside Alliance chief executive Tim Bonner, adding that he didn't want rural areas to have special treatment, just equality.

"The whole point of a universal service obligation is that it applies to everyone, and this one was suggested specifically to ensure that the most rural, hard-to-reach properties will enjoy workable broadband speeds. High-speed broadband is an essential service for modern life, and we believe a lack of broadband capacity in rural areas is holding back the countryside, socially and economically." **mm**

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Pre-Built Vs Self-Made

Mark Pickavance discusses the various merits of buying a PC either in bits or pre-assembled

I'm come clean up front and admit that, with the obvious exception of laptop systems, I've built all my computers from scratch. My reasons for doing that are numerous, but given the job I've got, it would seem to fly in the face of logic to buy them pre-made, with all the parts in them chosen by someone else.

If I had to put a number on it, I've probably built somewhere between 50 and 100 machines, so I've got the exercise down to a fine art that I can complete rapidly and with a high degree of success.

However, some people who read Micro Mart are more comfortable with others doing that for them, and in the same way I don't mess with what's under the bonnet of my car, I can fully rationalise their position. For them, the only choice is a pre-built machine, though there are a number of businesses that will build a PC to exacting specifications. They effectively give you the choice that a self-build offers, but the actual assembly and testing is done for you. This option has a cost premium, and often a delay dimension, because the parts need to be sourced at the

point of construction. And interestingly, that's why I first got into making my own systems: because it was cheaper.

But is building cheaper now or do the bulk buying benefits that Dell, HP and others can swing these days undermine that argument?

Cost Breakdowns

In trying to answer that question, I've taken three computers that you can buy today, each at one of four performance levels and then worked out the cost to make the same thing from bits.



This isn't exactly scientific because, for example, you can't buy Dell desktop PC cases independently, but it should give us a better handle on what sort of deal a pre-built PC can be.

HP 280 G1 MT Desktop – £249.99			
Function	Part	Retail option	Cost
Processor	Intel Pentium G3250 3.2GHz	G3250	55.98
Memory	1x4 GB DDR3-1600 SDRAM	4GB 1866MHz DDR3 CL10 DIMM HyperX Fury Red Series	£16.88
Hard Drive	500GB 7200rpm SATA	Toshiba DT01ACA050	£37.42
Optical Drive	SATA SuperMulti DVD writer	Samsung SH-118BB	£10.49
Motherboard	Intel H81 Based	MSI H81.M-E33	£37.49
Software	Operating System: Windows 7 Professional 64 (available through downgrade rights from Windows 10 Pro)	Windows 10 Home 64-bit OEM	£73.98
Graphics	Intel HD Graphics	Intel HD Graphics	0
Input Devices	Universal USB wired keyboard HP USB mouse	Logitech B100 Optical mouse and Kensington wired keyboard	£11.47
Power Supply	180W standard efficiency	Xenta 300W PSU	£10.98
Case	One MCR external drive bay One 5.25" ODD external drive bay One 3.5" internal drive bay One 2.5" internal drive bay	Xenta B138A mid tower computer case	£14.99
Total			£269.68

“ But is building cheaper now, or do the bulk buying benefits that Dell, HP and others can swing these days undermine that argument? ”

After each breakdown, I'll talk about what options are available, and if they're worth adding or not for that machine. That's important, because while the entry-level spec for many machines comes at a very competitive price, once you've added a few important extras, it might not seem such a bargain.

What I've left out of this exercise are machines like Acer's Aspire XC-704 Desktop (£199.99), because they don't have socketed processors, and making something equivalent would be very challenging.



HP 280 G1 MT Desktop – £249.99

As the cheapest PC, I wasn't expecting much from this platform, but if your needs are modest, then it will probably suffice. It's built around the Anniversary Pentium G3250 clocked at 3.2GHz, has 4GB RAM plus a 500GB hard drive, a DVD writer and comes with Windows 7 Pro 64-bit.

The full spec with what equivalent parts cost to buy is shown in the table above.

I was slightly shocked by this, because for various reasons I'd assumed that once I added in the cost of Windows that buying the parts to make an equivalent machine would be significantly more.

And you could get an OEM Windows 7 licence for £20 and make the self-build substantially cheaper. However, at this time, HP is doing a trade-in deal, where if you're a business you can trade an old PC in and get £100 knocked off, driving the cost of the HP 280 G1 MT down to just £149.99 after the cashback.

At that level you could buy this machine, put it into your own case and you'd still be better off than building it yourself, though



Dell Inspiron Desktop (3650) – £349			
Function	Part	Retail option	Cost
Processor	Core i3-6100T	Core i3-6100T	98.99
Memory	1x8 GB DDR3L-1600 SDRAM	Crucial CT102464BA160B 8GB DDR3	£23.99
Hard Drive	1TB 7200rpm SATA	Toshiba 1TB HD	£39.86
Motherboard	Intel H110 Based	Biostar H110MD PRO	£43.98
Software	Windows 10 Home (64Bit)	Windows 10 Home 64-bit OEM	£73.98
Input Devices	Dell Multimedia Keyboard-KB216, Dell Optical Mouse-MS116	Logitech B100 Optical mouse and Kensington Wired keyboard	£11.47
Power Supply	240W (Proprietary design)	Xenta 300W PSU	£10.98
Wireless	Dell Wireless 1707 Card 802.11bgn + Bluetooth 4.0	TP-Link TL-WN881ND	£12.99
Case	One 5.25" ODD External Drive Bay One 3.5" Internal Drive Bay Two 2.5" Internal Drive Bay	Xenta B138A Mid Tower Computer Case	£14.99
Total			£331.23



that would obviously invalidate your one-year warranty.

Time to move up to something with a higher performance and see if a clearer picture reveals itself.

Dell Inspiron Desktop (3650) – £349

This represents the typical desktop PC that Dell makes these days, and in many respects it falls into many of the traps that this company seemingly can't resist.

For a start, it uses a proprietary PSU design, so should yours fail, you won't be easily replacing it with a standard ATX unit. And that by definition caps the size of GPU you can use, because the 240W one that Dell uses isn't really up to the job of anything that needs a PCIe power line. For those reasons, and a few others, I'd avoid this machine even before you experience the numbers (see table above).

It's an abject failure from the pre-built corner, because not only is the Dell poor value for money, it's limited by its design team and their love affair with proprietary hardware.

The accessory selection is also dire. Dell wants a whopping £112.53 for a 1TB external hard drive for backing up, whereas

the typical retail cost of that item is less than £50! And you don't even get an optical drive as an option.

There's plenty of power in the Hyper-Threading Core i3-6100T, but few ways to exploit it in this machine.

The Dell Inspiron 3650 is undoubtedly a poster-boy for the self-build PC community.

Acer Aspire TC-705 Desktop PC – £629.99

For this sort of money, you might reasonably be thinking that you'd get a Skylake CPU, but actually this is a Haswell system that uses the old H81 chipset.

The processor on it is actually more expensive than its Skylake counterpart, so if you did build something equivalent, I'd go with Skylake and get more power for less money.

What's also weird is that Acer chose to put 12GB of RAM in it. On Z87/H87, this would really stuff the dual-channel memory mode by combining a 4GB and 8GB stick, but on H81 it only supports a single DIMM per channel, so it probably doesn't matter.

The GPU isn't a retail option, mostly because few in their right mind would run to choose an Nvidia GTX745, with its abysmal DDR3 memory bandwidth and paltry 384 CUDA cores. The GT-740 I've chosen as a replacement might only have 2GB of memory, but at least it's GDDR5! For those interested in making your own comparison, the system is coded PCDT.SXPEK.001.

Now, let's turn to the table at the bottom of this page. If you work for Acer, look away now.



Acer Aspire TC-705 Desktop PC – £629.99			
Function	Part	Retail option	Cost
Processor	Intel Core i5-4460	Core i5-4460	£160.98
Memory	1x8GB + 1x4GB GB DDR3L-1600 SDRAM	Crucial Sport 16GB (8GB x 2 Kit)	£52.98
Hard Drive	2TB 5400rpm SATA	WD Blue 2TB	£58.98
Motherboard	Intel H81 Express	Biostar H110MD PRO	£43.98
GPU	NVIDIA GeForce GTX745 4GB	Gigabyte GT 740 2GB GDDR5	£78.99
Software	Windows 8.1 64-bit	Windows 10 Home 64-bit OEM	£73.98
Optical drive	DVD-Super 8X Multi DL drive	Samsung SH-118BB	£10.49
Input Devices	Acer USB keyboard and mouse	Logitech B100 Optical mouse and Kensington wired keyboard	£11.47
Power Supply	300W (Acer)	Xenta 300W PSU	£10.98
Wireless	802.11 b/g/n/ + Bluetooth	TP-Link TL-WN881ND	£12.99
Case	One 5.25" ODD external drive bay 3.5" internal drive bays	Xenta B138A mid tower computer case	£14.99
Total			£530.81

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The GPU on my choice is much better than Acer's, as are the motherboard and the optical drive.

I'm seeing a trend here: the higher spec the PC becomes, the less value it represents in general. Unless I've missed something wonderful in the specification of this machine, then you could build something identical or better performance for roughly £100 less than Acer is asking.

I've also seen a few people moaning about the TC design, in that Acer chose to put the two USB 3.0 ports it has on the front and none on the back.

HP EliteDesk 800 G1 TWR Desktop – £948.65

In this penultimate comparison, I'm going to take a different tack, because this is a high-end machine. Instead of choosing the very cheapest options for the self-built version, I'll push the boat out a bit.

But that wasn't too difficult, because other than the CPU, there isn't anything in this that's remotely special. Why HP put a single 4GB stick of RAM in it I've no idea, because

with two 4GB sticks you get substantially better dual-channel performance with the Core i7 CPU.

Even before I worked the numbers, this machine had the air of 'business-people-will-buy-anything' about it (see table below).

Initially I tried just improving modestly on what HP put in this computer, and I came nowhere near the asking price. The notion that an i7 class processor (and an old one too) justifies this high price is patently ridiculous, and you could build a system to HP's spec for less than £550 easily.

So I loaded the self-build option with a gorgeous Fractal Design case, a much better motherboard, better mouse and keyboard, bigger PSU and quadruple the memory. I even swapped out the 500GB hard drive for a

500GB SSD, boosting drive performance by at least three times or more in the process.

It was all to no avail, because I was still £220 short of what HP is asking for this machine, admittedly with a three-year warranty. That's the price of a

PowerColor R9 380X Myst Edition 4GB video card, if you wanted to trick this rig out for some very serious gaming.

This is an extreme example, but expensive pre-built is rarely worth anywhere near what the parts would cost, even at retail pricing and with the very highest quality parts.

Apple Mac Pro Tower Desktop – £3339.99

Before the letters page overflows with people pointing out that you can't build Apple Macs, I included this for a bit of fun.



HP EliteDesk 800 G1 TWR Desktop – £948.65			
Function	Part	Retail option	Cost
Processor	Intel Core i7-4790 3.6GHz	Core i7-4790	£260.99
Memory	1x4GB GB DDR3L-1600 SDRAM	Corsair 16GB (2x8GB) DDR3 1866Mhz Vengeance	£55.98
Hard Drive	500GB HDD	Crucial MX200 500GB	£119.99
Motherboard	Intel Q87 Express	Gigabyte GA-Z97-D3H	£54.99
GPU	Intel HD Graphics 4600	Intel HD Graphics 4600	0
Software	Windows 7 Professional 64-bit	Windows 10 Home 64-bit OEM	£73.98
Optical drive	Slim SATA SuperMulti DVD writer	Samsung SH-118BB	£10.49
Input Devices	HP USB Keyboard and mouse	Microsoft Wireless Desktop 3050	£40.98
Power Supply	320 W 92% efficient, active PFC	Corsair Builder Series CX 430W V2 '80 Plus Bronze' power supply	£40.99
Case	One 5.25" ODD external drive bay 3.5" internal drive bays	Fractal Design Define R5 Black Pearl computer case	£77.99
Total			£736.38



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The point here is to break down the Mac Pro and see what building an equivalent PC would cost you. And since many Macs also run Windows these days alongside OS X, this seems a valid exercise.

Since Apple hasn't refreshed the Mac Pro since 2013, and maybe it never will, most of the equipment in its weird cylindrical case is pretty old. It uses the original LGA 2011 socket, the X79 chipset and DDR3 memory.

It isn't easy to get some of those parts for the PC, so I switched out the X79 to the current X99 platform and that dictated switching from DDR3 for DDR4, along with an LGA 2011v3 class Xeon.

Where making a copy gets really challenging is in respect of the video cards, because they're not standard, and their exact specs aren't transparent. It's been generally assessed that the AMD FirePro D500 is somewhere between the FirePro W7000 and W8000 in terms of performance, both of which have been replaced by the W7100 and W8100 respectively. I've included a couple of W8100s, because they've got more bandwidth, though they're probably overkill.

Once you include those cards in the price, the Mac Pro doesn't look quite as outrageous as it first appears. However, if your interest is gaming and not workstation graphics, then you could use a pair of AMD Fury X cards, save yourself nearly a grand and have even more bandwidth and performance.

And before someone writes in to tell me that FirePro are tuned for workstation graphics, I don't care how tuned a W8100 is, it can't compete on bandwidth and gigaflops with the monster Fury X or the upcoming Artic Islands hardware.

There's an obvious question there about 'Workstation' graphics and what really people get for their money, which we'll leave for another time.

However you slice and dice it, you can build something substantially more powerful than a Mac Pro with a £3339.99 budget,

Apple Mac Pro Tower Desktop – £3339.99			
Function	Part	Retail option	Cost
Processor	Intel Xeon E5 3.5GHz	Intel Xeon E5-1620V3	£277.36
Memory	16GB (four 4GB) of 1866MHz DDR3 ECC memory	Kingston HyperX Fury Black 32GB (4x8GB Kit) DDR4	£118.98
Hard Drive	256GB PCIe SSD	Samsung 950 PRO 256GB M.2 SSD	£137.99
Motherboard	Intel X79	Gigabyte GA-X99-UD4P (X99)	£194.99
GPU	Dual AMD FirePro D500	Sapphire AMD FirePro W8100 x2	£2,010
Software	OS X Mavericks	Windows 10 Home 64-bit OEM	£73.98
Input Devices	Apple keyboard and mouse	Microsoft Wireless Desktop 3050	£40.98
Power Supply	980W	Newton R3 1000W 80 Plus Platinum modular power supply	£149.99
Case	One 5.25" ODD external drive bay 3.5" internal drive bays	Fractal Design Define R5 Black pearl computer case	£77.99
Total			£3,082.26

almost regardless of how crazy you want to go on spec.

Pre-built Advantages

While the evidence I've presented does seem to suggest that pre-built isn't a good choice financially, there are other points that you should consider, some of which you don't get with the self-constructed option.

Reliability: While this isn't always the case, the likes of Dell and Acer would soon go out of business if they had a large number of returns. Therefore they make great efforts to put together systems that aren't inherently unstable and which have a high degree of hardware reliability.

When you pick the parts you might, as I have in the past, stumble on a combination

“ I'm seeing a trend here: the higher spec the PC becomes, the less value it represents in general ”

Warranty: The most obvious advantage is the cover against failure, because all pre-assembled computers are guaranteed to work for at least a year – and business ones for more than that.

While components do have some warranty coverage, you have to find out what's bust yourself, and then return it for a replacement. With a pre-built machine, the company will usually send a courier to collect it, and it will then return with either a replacement or fixed system.

It needs to be clearly understood that any data on the PC is unlikely to still be on there when it comes back, so having a retrievable backup on an external drive or another machine is a necessity.

that doesn't work well. The QA systems of large-volume PC makers, in contrast, would generally discover this mismatch before it was distributed widely.

I've also seen enough failed computers to realise that some user attempts to build them are better than others, and every pre-built PC is usually assembled by someone with experience in doing that job.

A common experience: Often pre-built PCs are shipped in the tens of thousands or even greater numbers, so there's a very good chance that many people have the same hardware. That's a useful resource to draw on should you have problems even beyond warranty periods. Most makers have forums, and they're an excellent place to find out if



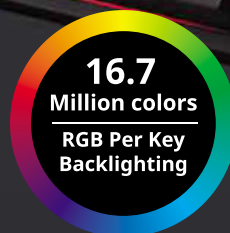
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your system has a common problem and an appropriate workaround.

Self-built Advantages

Along with the satisfaction of assembling a working system yourself, there are also a number of significant pluses to taking this route.

Specificity: Plainly put, you can have exactly what you want, regardless of how appropriate that is. Big system builders tend to try to funnel most of their customers into a narrow channel where they make the most profit. Because of that, they rarely offer even half the processors and a tiny percentage of the GPUs on offer.

If you really want a PC made to your needs, then it's certainly better to build it yourself.

Inside knowledge: If you build a system, then you're fully aware what's inside it and how it's put together. A pre-built solution might be a complete mystery, until it goes wrong and you open it up to discover what that might be.

Zero proprietary parts: The beauty of a modern PC design is that you can source many components from entirely different companies and usually they'll work when assembled into a PC. Many large PC makers, like Dell, use proprietary parts that you can't easily replace. Their thinking is that when the proprietary PSU, for example, breaks you'll buy a new PC and not a replacement PSU.

The proprietary card is one that some machine makers have played far too often, and it's a major reason for building machines yourself from entirely non-proprietary parts.

Greater choice: While PC makers have a range of systems and often options on what CPU, memory and storage they include,

there are often combinations they don't include. A self-built system can have any crazy combination in it tailored to a specific purpose that you just couldn't get a branded PC to address.

While there are some companies that will build whatever you ask, the cost of their hardware isn't going to be as cheap as buying the parts and making it yourself.

Higher-quality parts: A system from Dell or HP is made to a price, so it won't include anything that they consider superfluous. Pre-built motherboards are stark compared to their retail brothers, and the RAM on them

solution would cost and how much of a bargain that the pre-built system represents.

I've concluded, based on the figures I obtained writing this, that Intel in particular is keeping the cost of its processors artificially high.

While that might make it feel warm and fuzzy about its ability to manipulate the channel, it doesn't actually help it sell any more chips in the final analysis.

But the biggest challenge facing it is that modern computers are so powerful that unless you're doing something radical, like 4K gaming, then the computer most people need is the one they already own.

“ I’ve also seen enough failed computers to realise that some user attempts to build them are better than others ”

is usually unbranded and only rated for the minimum speed. These aren't the parts you'd choose if you built it yourself, which would usually be better.

Newer hardware: System builders are usually offering last season's processors and chipset on their budget hardware and sometimes even older. If you want something really current, make it yourself.

Price: You can get some amazing deals on pre-built equipment, so this isn't always the case. However, what a pre-built system allows you to do is focus on exactly where you want to spend and cost-cut on less important aspects. Most people can also reduce the costs by reusing some parts from their prior system, ideally.

Final Thoughts

I'm really glad that I did this exercise, because it confirmed for me some thoughts I've had about the state of the PC industry and how these companies are doing financially.

If we look at the breakdowns overall, with the exception of the cheapest machine, there are relatively few advantages to buying pre-built, because the price isn't as competitive as it once was.

If you're not convinced, it isn't a big job to open up the spec sheet on a machine you can buy and then go and find the prices for equivalent parts to make a copy.

Once you've put those numbers into a spreadsheet, you'll know what a self-built

In that respect, upgrading from a hard drive to SSD or putting a better GPU in an existing machine is the most cost effective way to revamp your experience, not buying or building a completely new PC.

This is a new reality that neither Intel nor Microsoft seems to have accepted, even if they're both feeling the effect of a shrinking PC market.

If the PC market is to see a resurgence, then the most expensive parts will need to get cheaper for both big system builders and home assemblers. And they'll need to come with technological advantages that aren't just an increased clock speed or a socket that didn't exist a year previously. [mm](#)



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Alphabet Pi: L

David Briddock meanders through Raspberry Pi technology from A to Z

THIS WEEK: Linux, Login, LEDs and Lego

Linux

Back in 1991 Linus Torvalds set himself the task of creating his own Unix-like operating system using the open source GNU tools and compiler (gnu.org). At the time it was a purely personal project, done just for fun and self education. Today Linux underpins a huge section of our computing world. It forms the foundation of Android, it runs on millions of cloud-based servers and it is deployed in a huge assortment of embedded projects: smart home devices, road vehicles, aircraft, industrial control systems, military weapons, space missions, scientific instruments and much more.

An open source strategy is a key part of the Raspberry Pi vision, and the official Raspbian operating system is itself only possible thanks to millions of hours of effort by the Debian Linux community. Without Raspbian, plus numerous other open source contributions, the whole Pi package would be much a much more expensive option. So, the Raspberry Pi as we know it today simply wouldn't exist without GNU, Linus Torvalds and the open source community.

Login

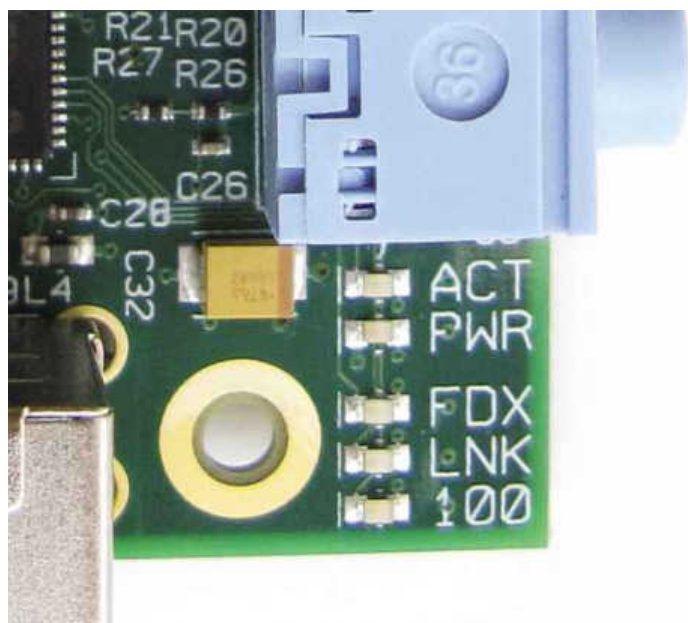
By default the Raspbian operating system's login defaults to a username of 'pi' and a password of 'raspberrypi'. With such a well known login it's a good idea to change the password, especially if your Pi is connected to a network. And any Internet-connected Pi needs a long and strong password string.

To change the password open a terminal window and type in the command 'passwd'. You'll be prompted for the old password before entering the new one; twice for confirmation purposes.

LEDs

Every Raspberry Pi board has a number of status LEDs. They are located in a corner of the board next to the 3.5mm audio jack and USB ports. Model B/B+ boards have five LEDs, but the Model A only needed the first two because of the missing network socket. The LED labels on a Model A/A+ and Model B/B+ revision 2.0 boards are identical, although it's worth noting that the original revision 1.0 Model B boards have slightly different label layout. Here's the list:

- ACT (green)
- PWR (red)
- FDX (green)
- LINK (green)
- 100 (yellow)



▲ Pi board status LEDs

So, what do these LEDs actually tell us? The green ACT (or OK) LED indicates SD Card read/write activity. A steady red PWR light means there's a 3.3V power supply. The green FDX LED lights when the Ethernet connection is in full duplex mode. The green LINK LED is on when an Ethernet connection exists. And the yellow 100 (or 10M) LED shines when a 100Mb/s Ethernet connection is detected.

The elinux.org troubleshooting web page (goo.gl/tuCV4) offers detailed LED descriptions and problem solving advice.

Lego

With its diminutive board size the Pi and Lego bricks make great play pals. Both Pimoroni (goo.gl/xiT9NK) and Cool Components (goo.gl/PnQgnW) sell ready-made Lego connectable cases. If you already have some Lego lying around, you could always try to build your own custom case.

Just as with Lego itself, the only limits are your imagination. You could create some kind of automated machinery, an interactive toy or a range of robotic vehicles. For more inspiration checkout these Lego-related Raspberry Pi blog posts (raspberrypi.org/blog/tag/lego). [mm](#)



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Remembering... Sierra On-Line games

We recall a ground-breaking, but often risqué developer from the early PC

Hands up those of you old enough to remember *King's Quest*? What about *Space Quest*? Or the *Leisure Suit Larry* games? These three game series for the early PC are some of the most iconic. Show a screenshot to anyone who's 40 years old or more, and they'll be able to tell you the difference between *Police Quest* and *Space Quest*, and how rubbing berries on yourself is a good thing to avoid being eaten by a swamp monster.

The Sierra On-Line graphical adventure games were way ahead of their time, in terms of both the number of locations, graphical content, interaction with the player and quite often, risqué content, especially in the form of *Leisure Suit Larry*.

Basically put, if you owned a PC in the 80s, then there's a pretty good chance you had at least one of the Sierra On-Line titles, stuffed in the drawer of your computer desk. They were games that created a generation of digital adventurers. Where once gamers worked with static images and countless commands to enter on their 8-bit adventures, Sierra On-Line brought a level of interaction and complexity that hadn't yet been seen. It was quite an incredible achievement.

Fast forward some years later, and Sierra On-Line pushed the boundaries again, both in graphics, interaction and content, with the release of the full-motion video point-and-click game *Phantasmagoria*. With scenes of violence and even a rape scene, *Phantasmagoria* certainly brought with it a hefty amount of controversy – enough to shock several groups into actively banning it. But that only encouraged sales of the game.

For me, the best Sierra On-Line game was *Space Quest 2: Vohaul's Revenge*. With a perfectly pitched level of comedy and a great graphical puzzle to work out, it's the one game in the entire Sierra library that really stood out for me (also, I was never allowed to play *Leisure Suit Larry* at home).

Its History

Although the name Sierra On-Line started in 1982, the company dates back to 1979, when the company was known as On-Line Systems.

It was founded by husband and wife team Ken and Roberta Williams, who started out programming graphical adventures for the Apple II, with the company's first game *Mystery House*.

The success of early titles such as *Mystery House*, *Wizard and Princess* and even a *Pac-Man* clone called *Jawbreaker*, saw the company enjoying an influx of cash. Never one to shy away from controversy, the company also released a game called *Softporn Adventure*, with a decidedly risqué cover involving a hot-tub and some of the female members of the company.

By the mid-90s, Sierra On-Line was one of the successful companies in PC gaming and valued at over \$15 million dollars. By 1990, the most successful game from the Sierra On-Line stable was released, *King's Quest V*, which sold more than 500,000 copies – a record that wasn't beaten for years.

Phantasmagoria, though, became the best selling game of the company, in 1995. Grossing over \$12 million and selling 300,000

Did You Know?

- The hot-tub image women are (from left to right): Diane Siegel, On-Line's production manager; Susan Davis, the company bookkeeper; Rick Chapman, a waiter from a local restaurant, and Roberta Williams.
- CompUSA, a retailer, refused to stock *Phantasmagoria* when it was released.
- *Mystery House* is considered the first graphical adventure game.
- *Police Quest* is based on the experiences of real-life highway patrol officer Jim Walls.

copies in the first weekend, it was only beaten by Windows 95 and Microsoft Plus!

The Good

Great point-and-click games, with cheeky humour, superb graphics and mind-bending puzzles.

The Bad

The content was often quite unnecessary, and in the case of *Phantasmagoria* it was a little too much for most gamers.

Conclusion

Despite the controversial content, Sierra On-Line games made an important mark on PC gaming history. While looking very dated nowadays, they still bring back some fond memories. [mm](#)



▲ The *Space Quest* games were some of the best graphical adventures for the PC



▲ The superb *King's Quest* set quite a high bar for the competition



▲ *Phantasmagoria*, despite its content, was ground-breaking

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Your Letters

Keyboards 101

Having read the above article, I'm surprised that Mark did not mention the "annoying" differences between the UK and US versions of the QWERTY keyboard in terms of actual keys and layouts. That's a pity because many second-hand or "refurbished" laptops are sold here, but with the US configuration, and it's quite confusing to change from one to the other.

This happened to me about a year ago when I bought a refurb Asus 1225B netbook from eBay UK (I knew it had the US layout before I bought it, so no quibble there), and then I 'remembered' that keyboards can be remapped by the right s/w – which turns out to be the Microsoft Keyboard Layout Creator (probably amongst other available s/w) which is a free download from 'good old' MS.

So, after a few hours of trial and error, I was able to get the 'correct' UK English

symbols (including the shifted and Shift+Ctrl characters) on six of the most important keys, and then to print out stick-on labels on my Brother PT1230PC Strip label printer (bought from LIDL of all places) to stick on those keys!

The case of the Asus has a rather nice 'Apple-like' white gloss finish with a natty little Asus on it, silver screen surround, and silver keyboard surround with white keys – so putting nice white stickers on those six white keys got me a very functional and pretty little machine (the feel of the keys is actually very good and positive – one of the best keyboards I have used for a long time). FWIW, the machine cost me around £125, and the cost of the stickers was negligible in context.

You can just spot the labels, but you have to look quite hard!

John Allen



Livemail Discontinued

Like many of your readers I have just been informed that as from June, Hotmail can no longer be accessed via Livemail 2012. An email from Microsoft advised I should upgrade to Windows 10 and my life would be transformed and wonderful and my email would work perfectly. Call me an ageing cynic if you will but, surprisingly, I was unconvinced. I will wait to see how they intend to convert this OS into a continuing revenue stream before even contemplating the prospect of a Windows 10 install.

Now I prefer to use a desktop email client for a variety of reasons, so tried and tried and tried to transfer my accounts to Outlook 2007. I accurately followed various sets of instructions found on the web for POP3 and IMAP, all to no avail. As a short-term measure I thought I would take up the offer of one years free subscription to Microsoft Office 365.

I then discovered that this service is auto renewable and that I was required to leave my credit card details in the tender care of MS, no doubt in the (failed) hope that I would forget to cancel before the renewal date. Not a hope in hell of me doing that then. I am forced to the conclusion that all this is just another failed hard sell attempt by Microsoft.

Not to be beaten I scoured the net and found a free email client in the form of eM Client (www.emclient.com), a desktop email client. A small download later I installed the program, which then imported all my Hotmail settings and mail without a glitch. Voila!

I therefore heartily recommend this solution to all readers who find themselves in the same boat – or, should I say, the lack thereof.

Richard Holder

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Component Watch

Last week's magazine picked out five great all-round motherboards, so this week we decided to find the best prices for them...

If you need a new, current-gen motherboard for your Intel or AMD CPU, there are loads of options to consider. Depending on your needs, you can get a cheap or expensive board, you can get one that supports overclocking or one that doesn't. You can get a new one or an old one. Last week we picked five motherboards that'll get you started whatever type of system you're trying to build. This week, we've found the best price available for them.

Deal 1: Gigabyte GA-Z97-D3H

RRP: £87 / Deal Price: £58

Gigabyte's Z97 motherboard is as cheap as ATX Socket 1150 boards come, and if you're building a desktop PC we'd always recommend you opt an ATX form factor. This board is a Z97 chipset, which means it's also capable of supporting chips all the way up to a Core i7 (as long as they're of the Haswell variety) and it comes complete with overclocking features. For us, that's worth the £15 extra you'll pay over a less-capable Haswell motherboard, especially when the price has been slashed to under £60.

Where to get it: Ebuyer (bit.ly/20a32Ph)



Deal 2: MSI H170A PC MATE

RRP: £80 / Deal Price: £66

Intel's Skylake H170 motherboards are aimed at squarely at those building mainstream workaday PCs – broadly replacing the Ivy Bridge H77, Haswell H87 and Devil's Canyon H97. Although considered firmly mid-range (with no scope for overclocking), their support for relatively high-end features is more than enough for most home users. So, with this board you get up to sixteen PCI-E lanes (allowing for SLI mode graphics), alongside which this board has six SATA 6Gb/s ports, M.2 and SATAe ports, built-in HDMI, DVI-D and VGA, eight USB 3.1 ports and four USB 2.0 ports, built-in gigabit LAN and support for DDR4 memory. It pairs well with any (locked) Core i5 chip, and will serve you well.

Where to get it: LambdaTek (bit.ly/20frK0L)



Deal 3: ASRock Fatal1ty Z170 Gaming K6

RRP: £140 / Deal Price: £126

There are more expensive motherboards, but the ASRock Fatal1ty Z170 gaming board is the most expensive home system builders should bear. The Z170 chipset supports full overclocking of both CPU and RAM, and the Fatal1ty line features gold-plated connectors to facilitate electrically clean and high-quality connection between components. Of particular note is its dual BIOS, which allows you to have a backup BIOS in case of disaster – an essential feature for anyone who likes to keep their board on the cutting edge of firmware updates.

Where to get it: Scan (bit.ly/252djR9)



Deal 4: Asrock FM2A78 Pro4+

RRP: £108 / Deal Price: £66

If you're buying an FM2 or FM2+ chip, it's hard to find a board cheaper. The Asrock FM2A78 Pro4+ is pretty standard, with four DDR3 DIMM slots, triple monitor support and onboard gigabit LAN, three PCI-E slots and dual-graphics support, with five SATA 3.0 ports. Overclocking is limited, but it's available, and that's enough to avoid the extra expense of a more capable board.

Where to get it: CCL Online (bit.ly/1su04sm)



Deal 5: Asus A88X-GAMER

RRP: £100 / Deal Price: £87

The A88X chipset supports full overclocking on AMD chips and is the choice for anyone building a high-end AMD-based system – at least for the moment. Overclocking aside, The features in this board aren't far beyond the Asrock board above, but it does have eight SATA 3.0 ports, four USB 3.0 ports and ten USB 2.0 ports, as well as optical audio out. You don't need to spend any more on an AMD board right now.

Where to get it: BT Shop (bit.ly/1W47eSx)





Huge Fine Coming For Google?

Bring Eric Back To Life!

Science Museum needs your help

Did you know that the UK's first ever robot was called Eric? No? Well now you do!

Back in 1928, some plucky Brits decided to go ahead and build themselves a robot, and Eric was first seen by the public on September 20th, 1928 during his starring role in the opening of the Society of Model Engineers' annual exhibition.

Eric then toured the globe before disappearing, and nobody really knows what happened to him. None of that matters now, however, as the London Science Museum has taken to Kickstarter

to launch a campaign to bring Eric back from the dead (or whatever the robot equivalent of 'the dead' is). Based on original archive materials and channeling the help of a roboticist – yes, that really is a thing – the Eric re-build is slated to go on public display again for a month in October, before becoming the star attraction of the museum's Robots exhibition in February next year.

This campaign deserves a little help, we reckon. So, if you'd like to be part of Eric's new beginning, head for Kickstarter and type Rebuild Eric into the search bar to get more information.



European Commission looking into anti-competitive practices

Haven't we been here before? The European Commission could be due to slap Google with a whopping great €3bn fine if press reports are to be believed. The measure would relate to anti-competitive search practices, such as those the Commission investigated Google for a few years ago before ultimately accusing the company of hindering competition by dropping down some search results in order to promote its own products.

The Commission has gone after Google in the past and, according to news agency Reuters,

compromises have been suggested before now. An official announcement regarding any possible action is expected over the next few months, so let's all keep an eye on this one as, if the touted figure really was to be demanded by the Commission, surely even Google would have to wince?



Do you have a prebuilt PC or one you put together yourself? I've owned both types, but for more than a decade, I've been building my own, because I enjoy the experience of doing so, and because I like to upgrade things as I go along.

A prebuilt system, obviously costs more to cover labour costs, and that's fair enough. Having seen some prebuilt computers that friends and family have bought, I can honestly say the quality of the workmanship always exceeds anything that I've ever been able to achieve myself. Cables are tucked away neatly, airflow is maximised, and everything generally looks spick and span.

My computer, in comparison, is a slightly bashed-up metal box, overflowing with wires, that's also missing a few blanking plates at the back. It all functions okay, but it doesn't look great.

Personally, I'm probably going to continue building rather than buying my desktop PCs, but there may come a time when I just want the convenience of a prebuild. And when I look at the snakes' nest I currently have, it's an even more appealing idea.

What kind of desktop do you own? Would you consider taking a different route? Share your thoughts with us at letters@micromart.co.uk.

Anthony

GCHQ Joins Twitter

Twitter responds with good humour to geeky first post

UK Intelligence Agency GCHQ has joined Twitter. Its first tweet read, perhaps unsurprisingly, "Hello, world" in a nod to programming etiquette, and the Agency wrote of the tweet in an associated blog post "as a technical organisation with computing at its core, it resonated with many of our staff who have learnt to program during their career".

Why join now, though? The Director of Communications said that: "In joining social media GCHQ can use its own voice to talk directly about the important work we do in keeping Britain safe."

Never forget, though, that the Twitterati has a mind of its own. So, in typical British fashion, the good humour greeting GCHQ's introduction to social media was quick and plentiful. Some choice examples included "surely following count should be 'everybody'", "Why bother being on social media when you just read everyone's accounts and emails anyway?" and even the more mundane "hiyaaaa".

We don't know why we found that last one funny, maybe it's the latent Vic Reeves fan inside us, but we did.

So, from all of us at Micro Mart, we'd like to also wish our spooks a hearty "HIYAAA!" too.



Meanwhile... On The Internet...

Over the last couple of years the Google I/O conference (tinyurl.com/MMnet15a) has begun to generate the kind of internet chatter and hype that has traditionally been reserved for Apple's 'one more thing'-suffixed presentations (tinyurl.com/MMnet15b). Though never quite the showy, slick affairs Steve Jobs presided over, they have nevertheless given us plenty to talk about. This year being no exception.

Absolutely (tinyurl.com/MMnet15c) everyone (tinyurl.com/MMnet15d) wanted (tinyurl.com/MMnet15e) us (tinyurl.com/MMnet15f) to (tinyurl.com/MMnet15g) know (tinyurl.com/MMnet15h) what the firm was up to, not least Google itself (tinyurl.com/MMnet15i) and to speculate about how the integration of it's various assistants into hardware known as Google Home (tinyurl.com/MMnet15j) would stack up in a head-to-head with Amazon's Alexa (tinyurl.com/MMnet15k) in terms of making life easier for the terminally lazy, and to wonder what exactly all it's other plans added up to. However, many came to the conclusion that the answer to that last question was 'not much, really'.

The main criticism appears to be the me-too nature of the key products; Home pretty much equals Alexa, Duo is a clever, low-bandwidth take on the multitude of video messaging apps in existence, and its new chat app, Allo, is a product that appears to step on the toes of some of the firm's own offerings (tinyurl.com/MMnet15l). It's also the latest in a long line of Google-derived efforts in the marketplace (tinyurl.com/MMnet15m). There was also the move from the aborted augmented reality of glass into the virtual reality world begun by the half-joking, Trojan horse, Cardboard project that has now flowered into something called Daydream.

A hint as to why it's so keen for us to be chatting using its software is in the debate that has surrounded Allo, and the decision to provide end-to-end encryption as only an option, rather than the default setting it is in software such as WhatsApp and Viber. While the technology that can be used to encrypt you Allo chats is the same as that used by WhatsApp (known as Signal: tinyurl.com/MMnet15n), it will only be in use when you are chatting in Allo's so-called Incognito Mode. The reason for this, it appears, is that Google is keen for Allo chats to integrate with its AI assistants, chatbots and – no doubt – advertisers, but for this to happen, it must be able to 'read' your messages and cull data from them, which it can't do if you're encrypting (tinyurl.com/MMnet15o).

However, in the light of some high profile criticism of the decision not to end-to-end encrypt as standard (tinyurl.com/MMnet15p) it appears that some Google staff are keen to address the situation before the app sees the light of day (tinyurl.com/MMnet15q). When that will be is, as yet, unclear.

Hacking cases appear weekly these days, but documents handed to the National Museum of Computing (www.tnmoc.org) promise to offer a fascinating insight into one of the first such cases to attract attention in the UK (tinyurl.com/MMnet15r).

Back in the mid-eighties, none other than Prince Phillip was a trailblazer for the use of electronic communication via British Telecom's new Prestel system (tinyurl.com/MMnet15s). However, a then-22 year old Robert Schifreen firmly believed that the pre-internet system was insecure, and promptly set about proving his hypothesis by hacking the royal's inbox. The white hat later found himself in a dock defending his actions, after he rather charmingly rang Prestel to tell them what he had done, half-hoping he'd get a job out of it (tinyurl.com/MMnet15t). He was acquitted by the House of Lords in 1987, though his case ultimately led to the Misuse of Computers Act, which arrived at the start of the nineties.

The Museum believes this addition to it's archive paints a vivid picture of a time – only 30 years ago – when computer security was looked at very differently to how it is now, and we'd have to agree. It certainly highlights how far we've come.

While we're talking about old-school hacks, a breach of LinkedIn systems that occurred around four years ago came back to haunt the social network this week. Via a report on *Motherboard* (tinyurl.com/MMnet15u), it was revealed that something like 117m email and passwords for the site were being touted around for sale on nefarious hacker websites.

Allegedly obtained during a hack in 2012, initially thought to effect something like 6.5m users (though that number was never confirmed, and appears to be seriously underestimating the reality: tinyurl.com/MMnet15v), the latest tranche of information appears to have taken LinkedIn by surprise. For it's part the company says it is assessing how many of the accounts are still using the same passwords. Might be worth doing a reset if you haven't already...

While that hack probably took a fair bit of work and expertise to execute – though LinkedIn's password encryption protocols left a little to be desired – we do wonder what state the people responsible for handling the database of, er... 'herbal relaxants' site The Trees Network were in when they left a whopping 10 million chatroom messages, emanating from some 44,000 users, open for all the world to see (tinyurl.com/MMnet15w). Unsurprisingly, given the demographic, it's likely that the police would have been interested in reading some of them.

As the site's Reddit apology stated, though (tinyurl.com/MMnet15x), there was little in there that wasn't already visible to anyone lurking on the site – so it's as much a reminder that one should be careful what one says online, as much as it is a massive security mess up.

.AVWhy?

Videos For Your Eyes...
Not Necessarily For Your Brain

Cinema is littered with dystopian visions of future society, some have even tried to imagine what horrible forms our consumer culture could morph into given enough time and the right (or wrong) prods. However, *Hyper-reality* by Keiichi Matsuda, is six-minutes of migraine inducing sci-fi that takes the millennial world and throws it forward into a world where augmented reality is king, and every surface is virtually emblazoned with information, colour and animation. It's hellish, and scarily probable (vimeo.com/166807261).



Caption Competition



"Marcel Marceau discovers one of the downsides of mobiles..."

This funny lookin' fella was the subject of the Caption Competition in MM1413, and here are the best suggestions:

- **doctoryorkie:** "Who are you calling a bozo?"
- **Thomas Turnbull:** "Mobile phones - it's a funny old business."
- **johnbarry:** "You've got to be kidding."
- **doctoryorkie:** "Do I look like I am joking?"
- **Ondrive:** "... and the government promised there were no adverse effects to prolonged mobile phone use..."
- **JayCeeDee:** "You were only supposed to blow the bloody doors off!!!"
- **Thomas Turnbull:** "What do you mean you can't make it 'cause the cars fallen to bits again?"
- **Ondrive:** "Yeah! They took my car, my massive shoes, a bunch of flowers, fifty feet of tied-together handkerchiefs, a waterpistol, and all my pies... Said I could keep the flip-phone, though."
- **BullStuff:** "Hello, is that the Agency? I said I need a circus job, NOT A FLIPPIN' PANTOMIME!"
- **blacklion1725:** "If Sir Alex Ferguson and Mick Jagger ever had a baby..."
- **Thomas Turnbull:** "Complaints department - There seems to be some funny business going on with my phone."
- **doctoryorkie:** "I bought your iCar. There are no windows and the doors fell off."

The winner, however was Jayceedee with "Marcel Marceau discovers one of the downsides of mobiles..."

If you have a caption for the picture below, head to the 'Other Stuff' section of our forum (forum.micromart.co.uk), or email us your funnies via caption@micromart.co.uk, remembering to add the issue number to the email.



already, please just buy one

Dating Site Matches Up Trump Haters

Canada beckons for America residents

As it looks increasingly certain that 'The Donald' will nab the Republican nomination for the presidency (we never thought that we would be writing that last sentence), dating website Maple Match has cannily taken advantage of worries among Americans who might not want to live in the States should he actually become a resident at the White House.

The site (which you can find at www.maplematch.com) has promised to match Americans who cannot live with a Trump presidency with Canadians, essentially giving them a chance to look for love across the border and potentially move if the billionaire is indeed elected.

While this is clearly just a bit of fun, it does reflect many people's worries over what is currently happening across the pond.

Ofcom Wants Faster Wi-fi

Spectrum could be opened up

The state of the UK's wi-fi seems to be under continual debate and news from Ofcom will only serve to reinvigorate discussions as it seems that the regulator is considering opening up the frequency spectrum.

Currently, there are just four 80MHz channels allocated to wi-fi at the 5GHz band, so things can get a little busy during high traffic. A situation made worse by higher broadband speeds in urban areas, and the higher demands that come with them.

Fear not, though. Ofcom wants to free up some more of that band, effectively a couple of additional channels, for unlicensed use. Getting down to technicalities, Ofcom says it has a "specific short-term focus on the 5725-5850MHz band because early results from ongoing technical studies suggest that sharing with other users is feasible."

Fingers and toes crossed, then.



Snippets!

Linux 4.6 Unveiled

Mr Torvalds has released version 4.6 of the Linux kernel into the wild, with the latest version adding support for the USB 3.1 protocol, offering transfer speeds up to 10Gb/s, and also support for various ARM systems-on-a-chip.

You can also expect the 4.7 version to be released over the coming months, as Linus is already working on it as you read this. Lovely.

Chrome Cuts Flash

Google is going to drop Flash support on its Chrome browser from next year. Changes to the browser mean that apart from ten websites that will have Flash enabled by default (including YouTube and Facebook) Chrome will block flash content so users will have to choose to activate it on a particular site if they really, really want it. Clearly Flash's days have been numbered for a while, but this move will surely be the beginning of the end for the software.

A win for HTML5, then.

Mac Updates

Mac users saw a design tweak to iTunes as version 12.4 was released in a 17 May update. It wasn't a major overhaul, more of a streamlining to make navigation that bit easier.

Alongside the iTunes change, El Capitan was handed an update which again changed very little, other than updating security.

Expect this to be the last significant update before El Capitan is superseded by Apple's new OS X release later this year.

Warren Buffet Interested In Yahoo

Part of consortium bid for assets

Yahoo is, as you are probably aware, up for sale. The firm is looking for buyers for its core assets as it continues to struggle to make the business work – this is still a slightly jarring statement, given the firm's one-time dominance of the web.

As various interested parties throw their respective hats into the ring, step forward big-time philanthropist and investor Warren Buffet. Mr Buffet is reportedly backing a consortium bid for Yahoo's core Internet assets with news Stateside suggesting that he has co-signed a letter and pledged funds for a potential bid.

Having somebody like Buffet touted in the press will do Yahoo no harm at all when it comes to finally getting rid of some of its assets. Whoever ends up buying those assets

will have quite the job on their hands as Yahoo needs a big old refresh.

Buffet has also bought a \$1m stake in Apple, so he obviously sees value there too. This is also good PR for a company that has also found itself having to answer critics about its own direction of late.



Second Major Banking Cyber Attack Discovered

Bank not named

Following news from earlier in the year of the millions stolen from Bangladesh's central bank, another major cyber attack has taken place on a commercial bank. Only thing is, we don't know which one.

The announcement came from the Society for Worldwide Interbank Financial Telecommunication (SWIFT), the organisation overseeing inter-banking messaging. It declined, however, to name the bank affected or say how much money (if any) was taken as a result of the breach.

By all accounts, the attack used techniques similar to those used in the Bangladesh attack earlier this year, with the hackers looking to send fraudulent messages pertaining to bank transfers to the SWIFT network. SWIFT said that those carrying out the attack had a "deep and sophisticated" knowledge of operational controls at the bank in question, which raises the possibility that insiders were involved – an angle that is a distinct possibility, according to the organisation.

Crikey.

Disney Infinity, Erm... Ends

Games studio shut down too

This is news that will upset parents and children the world over. *Disney Infinity* is no more. Disney has taken the decision to close down the studio behind the game, Avalanche Software, as “the lack of growth in the toys-to-life market, coupled with high development costs, has created a challenging business model”.

Fortunately, support for the title isn't ending immediately with two downloadable content packs relating to *Alice Through The Looking Glass* and *Finding*

Dory due over the next couple of months. The company won't be making any new games, though, and it seems that *Skylanders* and, latterly, *Lego Dimensions* have helped to see to the end of Disney's product.

Disney Infinity is a relatively young game, having first been introduced in 2013. However, despite tie-ins with Disney's *Star Wars* and *Marvel* properties it clearly still doesn't appear to be making Disney enough money to be worth continuing with.

Shame. It was a rather beautiful product, really.

New Digital Driving Licence In The Works

DVLA head tweets plans

Could the days of the physical driving licence be about to end? No.

Thankfully, that isn't the end of the story or we'd struggle to fill this bit. While it's not happening any time soon, the DVLA is working on a digital version of a driving licence that could be stored in the Apple Wallet for Apple users. We know that this is official as the chief executive of the DVLA

has tweeted an image of a possible licence alongside some words noting that this was a prototype.

In a follow-up post, Oliver Morley wrote that there was no timeline on the project, that it wouldn't be a replacement for the photocard, and that security was the priority. So while we have no idea when, or even if, this idea will land it's an interesting proposal nonetheless.

Rulebook Written For E-sports

About time?

It's taken more than a year of “intense negotiations”, but the founding of the World Esports Association is now complete. WESA, which trips off the tongue a little better, has been put together to bring “much needed structure, predictable schedules and transparency to the scene” and it's been put together with the backing of eight of the world's biggest e-sports teams.

Within the Association, the player-elected Player Council will also represent pro gamers on various fronts, in an attempt to stave off more of the bad headlines esports has attracted of late. With match-fixing arrests and accusations of drug-taking and illegal gambling, WESA's formation should help the scene to mature, as well give e-sports further credibility to those outside the industry.

BBC Recipe List Takedown Angers Thousands

iWonder and Newsbeat sites also shut down

When it was revealed that the BBC's library of 11,000 recipes were to be taken down as the result of cost cutting decisions following the government's White Paper on the corporation's future, the good people on the Internet did the only thing they could reasonably be expected to do: sign a petition.

Within hours of its launch at change.org, the ‘Save the BBC's recipe archive!’ petition had amassed well over 100,000 signatures and it's fair to say that Twitter was also awash with the collective ire of the people. The BBC's many online presences are likely to undergo more cuts and changes over the coming months and you can expect more criticism to be thrown around when they do. Let's wait and see how this all pans out.

HTC Vive

The first of the new generation of VR kits has finally arrived

DETAILS

- Price: £689
- Manufacturer: HTC/Valve
- Website: goo.gl/aODFMc
- Requirements: Nvidia GeForce GTX 970 / AMD Radeon R9 290 or better, Intel i5-4590 / AMD FX 8350 or better, 4GB RAM, HDMI 1.4, DisplayPort 1.2 or newer, USB 2.0, Windows 7 or later

The HTC Vive, in case you don't know, is a VR headset and controller kit designed by Valve and HTC. It's beyond any VR headset you may have tried before, including early releases of the Oculus Rift, and certainly it's better than the countless number of smartphone-powered headsets. The OLED display with its 2160 x 1200 resolution is quite magnificent, plus a fast 90Hz refresh rate and a 110° field of view also help to drastically improve the visual impact and prevent the notorious feeling of sea-sickness.

The kit itself is made up of several parts. There's the headset, with a strip of three five-metre cables protruding from the headband and terminating in HDMI, USB and power. Then there's also a fourth cable that acts as a headphone pass-through. There's what's called the Link Box, which pairs the cables from the headset to a power plug, as well as HDMI and USB cables that attach to your PC.

There are two sensor stations, called Lighthouse stations, each measuring 118 x 100 x 42mm. These are designed to be placed at a raised height at opposite sides of the playing space, looking down at a slight angle.



▲ The HTC Vive headset is big but quite comfortable to wear



▲ The entire kit is well presented, with generously long cables included

The Lighthouses cast an array of infrared signals over the area, which the headset sensors pick up. This increases the accuracy and sensitivity of movement of the wearer and their actions. These, too, require power and can either communicate wirelessly or via a lengthy 10-metre optical cable. Additionally the Lighthouse sensors come with a wall-mounting kit, so be prepared to drill holes in the wall if you're serious about VR.

Finally, there are a pair of controllers, which resemble a cross between a Wii controller stick and a PlayStation Move controller. Each stick features a trigger button, Steam overlay

button, menu button, two side grips, haptic feedback and a touch-sensitive pad. Depending on the game or the demo, the controller's buttons act differently. They also represent themselves differently in the virtual world too, either as the controllers (graphically displayed) or a pair of hands, guns, a tennis racket, fishing rod and so on.

The accuracy and visual aspect of the virtual world within the Vive is astounding. From comic book-like mini-golf, through to being in orbit around Jupiter, the clarity and depth is mind-blowing. Gaming is reasonably easy, provided the controller support is there, and fast moving



imagery isn't too much of an eye-strain either. In fact, the degree of accuracy is so good that you could place the controllers down in a virtual environment and easily move toward them and pick them up.

The required PC specs, though, sting somewhat. An i5-4590/FX 8350, Nvidia GTX 970/Radeon R9 290 and 4GB of memory are quite steep. However, the Vive kit currently costs £689, which is a considerable sum for anyone to consider spending.

So is the HTC Vive worth buying? Well, yes and no. Yes, if you have the space (at least a two metre square) and your PC comfortably meets the minimum requirements. No, if you couldn't swing a cat in your room and your PC lacks the necessary GPU grunt.

For those who fit the yes category, the HTC Vive is an incredible piece of hardware; even skeptics would find it hard not to be impressed. You can easily lose yourself in it for hours, and that's just with what's currently available. If this is what the new generation of VR looks like, then count us in.

mm David Hayward

Utterly incredible but expensive



Seagate Mobile HDD 2TB

Seagate play devil's advocate for those comparing speed and capacity

DETAILS

- Price: £93.37 (Saverstore)
- Manufacturer: Seagate
- Website: www.seagate.com
- Requirements: SATA 6Gbps interface
- Part No: ST2000LM007

Seagate has something of a battle on its hands with laptop users, because once you've used one with an SSD, it's difficult to go back to using a mechanical hard drive. But as its latest laptop storage designs show, it still has one card up its sleeve and that's capacity.

The ST2000LM007, to give its full title, is available in either 1TB or 2TB capacities and also as a straight drive (reviewed here) or in encrypted or encrypted/FIPS flavours.

What's most impressive about it is that even the 2TB model weighs just 90 grams and is 7mm thick. That's 25% lighter than the model it replaces, if you're keeping score. Using the standard 2.5" form factor, it should fit into almost any laptop designed to accept SATA drives this size, where you have access to make the swap.

For those who go with one of the government-grade encryption models, Seagate promises that being secure won't make the drive thicker, heavier or degrade the performance.

It also says these drives can survive an operating shock of up to 400Gs and non-operating loading of 1000Gs. As humans can't actually withstand either of those stresses, make sure you aren't holding the drive when they experience that at any point.



	Read [MB/s]	Write [MB/s]
1TB	143.3	140.8
4K	1.473	1.436
Seq	143.3	144.3
4K	0.550	1.518

all like 2TB of lighting fast flash in our laptops, the ST2000LM007 is a singularly more affordable option.

If you have a laptop that can accept two drives, that's the ideal situation, because you can use a small SSD to install the OS and apps, and this drive for your data storage. Those with only a single drive have to make a judgement call, because for what this drive costs, they'll only get a 512GB SSD or a quarter of the Seagate's capacity. It comes down to how much data you need to carry around with you and if you're willing to sacrifice high performance to have more.

The ST2000LM007 is an impressive piece of drive engineering, but I do wonder how much further the debate between this and SSD technology can go, given the speed at which SSD prices are falling.

mm Mark Pickavance

Lots of drive space and decent performance

Being able to handle that level of abuse has also allowed Seagate to offer a two-year warranty on the drives – longer than most laptop makers will give you.

In terms of the performance you might reasonably expect, Seagate claims 140MB/s, and none of my tests refute those numbers.

Using Windows 7 SP1 on a Skylake PC, I got 143.3MB/s

reads and 140.8MB/s writes using CrystalDiskMark. By laptop drive standards, those are highly respectable numbers, although they're about a third of what you might expect out of a decent SATA-connected SSD.

However, a 2TB SSD like the Samsung 850 Pro is easily £680, and this one costs less than £100.

And that's the rub really, because while I'm sure we'd



Zyxel Personal Cloud

Zyxel enters the NAS market with personal cloud aspirations

DETAILS

- Price: £87.99 (Ebuyer)
- Manufacturer: Zyxel
- Website: www.zyxel.com
- Requirements: Wired Ethernet network

Zyxel is one of those companies that effectively takes a known concept, rendering it into an affordable and accessible solution. And that sums up the Zyxel Personal Cloud (NAS326), for those in the market for a small, cheap, yet powerful dual-drive NAS.

As neither Western Digital nor Seagate made this, it's sold without pre-installed hard drives, making it perfect for anyone who owns a spare 3.5" SATA drive and needs centrally stored media or backups.

Installation is relatively straightforward. The front fascia slides off, revealing two drive trays, into which you can mount any 3.5" or 2.5" SATA drives, and once there, you can power up the NAS326 and configure the system to your preferences.

With two drives, you're limited to RAID 0 (stripe), RAID 1 (mirror) or JBOD

Specification

- CPU: Marvell Armada 380 1.3 GHz.
- Memory: DDR3 512MB .
- Two 2.5" or 3.5" SATA-2 hard disk interface supported up to 12 TB (6 TB x2).
- One gigabit Ethernet RJ-45 connector.
- Two USB 3.0 ports.
- One USB 2.0 port.
- Buttons: Power, copy/sync button, reset button.
- Smart fan design.
- Power use: 28W under full loading with dual internal HDD, external HDD x3), 5.5W in standby mode.



(just a bunch of drives) arrangements. However, with 10TB drives becoming available, capacity even on a dual-drive system can be huge, depending how much you have to invest in them.

I put two 2TB Western Digital Red drives inside the review hardware, and the system configured them in mirror mode by default. Not long after that, the Personal Cloud appeared on my internal network, featuring public shares for video, music

and pictures, and allowing me access to the built-in web interface.

My initial reaction to the Zyxel Personal Cloud interface was positive, because it's an attractive icon-based model that even those relatively new to NAS should find comforting.

However, when you click on the icons, only some invoke a windowing interface, whereas most spawn a totally new web page, which was obviously designed by someone else who



has never put 'graphical' on their résumé.

Worst of these sub-pages is for 'Administrator' mode, which is reminiscent of the web interfaces that routers suffered from five years or so ago. Many

of core functionality. Dropbox, Time Machine and iTunes are all supported inherently.

There's also the merest hint of installable apps in the form of 'Packages' that you can install, like WordPress,

RAM. The CPU side of that equation could also be a problem, because the Marvell ARMADA 380 (MV88F6810 ARMv7) 1.3GHz processor is single core. Because of this, I'd recommend you don't load every package ZyXel provided, even if there aren't that many to choose from.

But in many ways, these things are just a distraction from what the NAS326 does exceptionally well: file serving.

I've reviewed many inexpensive NAS options in the past, and none of them have been capable of reliably delivering in excess of 100MB/s both reading and writing over a gigabit network. At this one job, this hardware is stellar and much better than I was anticipating in a RAID 1 pack. Because of that, I'd heartily recommend this to anybody who wants a cheap DLNA, FTP or general file server, but doesn't fancy paying for Synology hardware.

Where it could be better is in respect of the interface I've already mentioned, and also I wasn't overly impressed with the placement of the USB ports.

There are three USB ports, consisting of two USB 3.0 spec at the back and a single USB 2.0 port on the front. The port on the front is associated with a button that allows you to automatically copy/sync the contents of a USB storage device inserted in any of the ports.

ZyXel should have put one of the USB 3.0 ports on the front, because you don't want to wait a long time for an upload, and going around the back isn't convenient.

I'd also like tool-free drive trays, but it's a job you only do once, so that's not a major problem.

All in all, ZyXel did a good job on its Personal Cloud product in all the places that are the most important, but it put less effort into the more esoteric features.

It will be interesting to see if it polishes its interface and adapts its thinking as this line evolves, which hopefully it will.

mm Mark Pickavance

A cheap NAS box that is surprisingly fast



“ ZyXel did a good job on its Personal Cloud product in all the places that count ”

of these controls should be in a graphical 'Control Panel', because creating shares or adding users aren't features you should have to hunt for.

It's all a bit of a mess, and it looks like it started with good intentions that were abruptly curtailed.

Those who brave the Administrator pages will find that ZyXel has provided plenty

personal cloud functionality (ownCloud) and a Google Drive client. There aren't many packages, and some of them require you to preinstall PHP-MySQL-phpMyAdmin first, but at least there is some system customisation.

That ZyXel didn't include more is probably not a bad thing, because the NAS326 only has 512MB of DDR3

Crucial Ballistix Sport LT DDR4-2400 32GB Kit

Crucial unleashes a memory monster of mythic proportions

DETAILS

- Price: £119.99
- Manufacturer: Crucial (Micron)
- Website: uk.crucial.com
- Requirements: System capable of accepting four 8GB DDR4 UDIMM modules, OS that can address 32GB
- Part No: BLS4C8G4D240FSE

As a seasoned technology reviewer I'm rarely shocked these days, but the arrival of this memory kit from Crucial truly blew my mind on numerous levels. I've covered Ballistic Sport products before, and as before, these are turned out marvellously.

My review modules came in with heat spreaders in a rich red colour, with silver highlights and a digital camo motif. You can also get these in white or grey, if that better suits your system.

The heat spreaders don't extend beyond the edges of the UDIMM, so these are just



32mm from top to bottom – not quite low profile but jolly slim all the same.

Where I started to swoon was when I realised that for less than £120 this kit consists of four 8GB modules, providing a total of 32GB of memory. That's a huge amount of RAM for a desktop PC, whatever you've decided to do with it.

Comparing that to my first computer that had 16384 bytes of RAM, a PC built with these would have more than

two million times more memory. Sheesh!

It's worth noting that not all systems can accept four modules, and the ones that could probably make the most of this configuration are those with an X99 chipset. However, I tested them on a Z170 motherboard, and they worked flawlessly.

They also don't need much in the way of setting up, due to the numerous SPD profiles that they contain. I've seen modules with lots of SPD settings before, but nothing quite like this. There are no less than ten JEDEC speed settings from 675MHz to 1200MHz, and 14 XMP ones, going from 530MHz (7.0-7-7-17-25) to 1200MHz.

A reason for so many is that there are eight, at 1200MHz each with different timings, although interestingly all the XMP ones utilise 1.2 volts.

Out of the total of 24 timings, you'd be pretty unlucky to not find one that

your system liked, and ironically that would probably be the default XMP profile that requires zero tinkering.

The only real caveat to using this much RAM is that you need an OS that can address more than 4GB (i.e. a 64-bit one). Those who picked a 32-bit installation, you mucked up.

There is one real question about using these: do you really need this much RAM? If I'm honest, then the answer is probably no. And I have reservations about even Windows 10's ability to effectively use this much memory other than allocating it to disk caching. But at this price the temptation is just to load the machine up, and then forget about RAM as a possible upgrade.

Yes, there are some platforms that can accept 64GB or 128GB, but then we're going super-silly, aren't we?

As for these modules, I can't fault the design, the massive capacity or the price. The world of PC memory officially just went places I never considered it ever would, and where it might go from here is rather daunting.

mm Mark Pickavance

Big memory option at a relatively low cost

Features

- Speeds start at 2400MT/s.
- Faster speeds and responsiveness than standard Crucial DDR4 memory.
- Ideal for gamers and performance enthusiasts.
- Four-channel architecture maximises data rates.
- Digital camo heat spreader available in white, grey and red.
- Easy plug-and-play installation.
- Intel XMP 2.0 profiles for easy configuration.
- Optimised for the latest Intel platforms.
- Limited lifetime warranty



Corsair M65 Pro RGB FPS Gaming Mouse

Corsair enhances its M65 mouse with even greater precision

DETAILS

- Price: £54.99
- Manufacturer: Corsair
- Website: goo.gl/IrvPIi
- Requirements: Windows 10, Windows 8 or Windows 7, USB 2.0 port (or better)

My current mouse is the Corsair Katar, a design I've come to truly appreciate for its unerring simplicity. By definition, the Corsair M65 Pro RGB FPS gaming mouse is a decidedly more complicated solution. There is a price implication to that, so is it worth the extra cost?

The headline feature of this mouse is its sensor. Most gamers like a mouse sensor with 2000dpi, but the M65 Pro's is capable of a staggering 12,000dpi.

I'm not sure any human can move that subtly, but more realistically it can register from 100dpi and then increment upwards at 100 extra DPI notches all the way to the 12,000dpi level. In terms of how these DPI readings are translated is also flexible, starting with 125Hz and capping at 1000Hz USB polling.

However you configure it, and this includes the eight buttons, all the settings are stored internally on the M64 Pro's own memory, allowing you to move to another PC seamlessly.

Another customisation option included are three removable weights, arranged in a triangle formation around the sensor.



Together these constitute 20.5g extra on top of the 115g that the M65 Pro weighs. You can remove/add them individually, adjusting the centre of gravity along with overall mass.

I'm happy to admit that this isn't a choice I fully follow, because while I can rationalise the lighter/heavier argument, I can't explain why you'd want an uneven distribution travelling on a flat surface.

As the 'RGB' moniker suggests, it also includes LEDs that can be set to one of 16.7 million colours with a wide range

of lighting effects using Corsair's Engine software.

The shape of the mouse will be familiar to anyone who has seen the original Vengeance M65, because it remains almost unchanged. It's tailored to right-hand use, with a distinctive textured thumb rest on the left and an equally sculpted right side. The wheel's contact area has been extended by offsetting of the mouse cable to the left of centre.

Behind the wheel are two buttons designed for DPI selection, and an LED between

these changes colour according to your selection.

Another three buttons are positioned to be thumb operated, and the largest of these has a scope graphic on it, to remind you that it's for sniping. It's configured to toggle a lower DPI for that precision shot, and using the Corsair Engine software, you can set that alternate DPI on a per-game/app basis.

My experience with this mouse was mixed, when I'd expected it to be brilliant when I first unboxed it. Removing the weights helped, and the sniper button had its uses, but for whatever reason, the M65 Pro just wasn't as natural in my hand.

I'm sure with time I can adapt, and being able to customise the settings should help once I've tweaked them correctly.

The M65 Pro is better made than the Katar, and better specified, but I'm not sure it's worth twice as much. However, compared with some gaming mice with less impressive sensors, it's still relatively cheap.

mm Mark Pickavance

A precision gaming mouse ideal for FPS gamers



Alpha 2

Following a visit to the Wearable show, Michael Fereday puts his heart into this review

DETAILS

- Price: £110 (Amazon)
- Manufacturer: Mio
- Website: www.mioglobal.com
- Requirements: n.a.

The Mio Alpha 2 is a product that has been designed to allow the users to check out how their heart reacts under various conditions. Like numerous activity tracker products currently available in the market, the Mio Alpha 2 kit consists of a wristband and a charging device. While this product possesses the ability to gather data regarding distance travelled and speed of movement, etc., the Mio Alpha 2's main concern is how such data affects the user's heart, which is something that appeals to me, as I have atrial fibrillation (AF) or an irregular heartbeat,

In common with other personal wearable devices, you will need to download the Mio Go app from the appropriate iOS or Android store.

Similar to a simplistic style of wristwatch, the Mio Alpha 2 combines a perforated black rubber wrist strap, making the device seem more appropriate for those into exercise, and a display screen. Measuring 35 x 20mm, the screen features a pair of buttons designated as A and B. These buttons, positioned either side of the screen, are used for switching between the Training and Zone Alert modes, plus making appropriate selections.

The Mio Alpha 2 needs to be charged before use. As this device will probably need power boosts in various



locations, Mio provides a pocket-sized charging dock that can link to an available USB port. The charger connects to the Mio Alpha 2 magnetically, as it provides its power to the unit's lithium-polymer battery. According to Mio, a fully charged battery should last a day when in full heart tracking operation or up to three months when acting as a timepiece.

There's a choice of methods when setting up the Mio Alpha 2. This process can be

carried out directly from the device or via the downloaded app as you create a profile with such personal details as name, gender and date of birth. You also have the option to use either imperial or metric measurements for height and weight, and you can choose whether to share data with the company or keep it private. This data is created by Mio Global technology, and it combines heart rate readings with those gathered from

distance covered, pace and speed measurements.

A heart rate indicator light, located below the screen, provides feedback regarding your heart's current state. This feedback is in the form of a coloured glow. In the default training mode, there are six colours ranging through a spectrum made up of light blue, blue, green, yellow, pink and red. Zone alert mode features just three colours, with blue, green and red being used to show if your heart is performing below, within or above a set target range.

Although you could use the Mio Alpha 2 as a basic wristwatch, it would be a waste of its built-in functionality, especially with the price of the product. The Mio Alpha 2 is the type of product that would appeal to a keep-fit fanatic who will appreciate the product's ability to provide feedback about their heart's condition during exercise periods and those interludes of rest.

mm Michael Fereday

Useful for exercise fans to check on their heart condition



Synology DiskStation DS116

Synology follows up the excellent DS115 with something even better

DETAILS

- Price: £127.20
- Manufacturer: Synology
- Website: www.synology.com
- Requirements: Wired network, broadband router

Looking through the specs of the DS116 was a curiously déjà vu moment for this reviewer. Having just covered Synology's DS216j, lots of components in it are remarkably similar. It uses the same processor, a Marvell ARMADA 385 88F6820 dual-core ARM chip, except it runs at 1.8GHz on the DS116, and not the 1GHz of the DS216j. That's potentially 80% more performance, and because this is a single-drive solution, that power should be more focused.

When you combine the higher clocked CPU and 1GB of RAM, as single-drive NAS units go, this is a speedy beast, enabling a wider scope of potential uses.

File serving hits the effective gigabit Ethernet cap on both read and write, at roughly 112MB/s for both, using a single WD Red drive. Using a faster drive won't gain you anything, because the limiting factor here is the bandwidth available through a single Ethernet cable.

In terms of the applications you can run, the DS116 has the same options as the DS216j, with a total of 76 available, combining Synology's own with the third-party ones available.

With plenty of power and performance, what's the problem here? It's the single drive facility.

While you can hang more storage off the two USB 3.0 ports and back up the installed drive contents to external drives, that's not the same simple redundancy of a dedicated RAID mirror.

That relegates the DS116 to a role where the data on it is secured elsewhere or isn't critical or one that's service based on not storage related.

For home use where you want to distribute personal files

about your network, the DS116 is fantastic, assuming you've put in place the appropriate backups. Without them, should the drive in the DS116 die, you'll be left with data loss, and the longer you run NAS hardware, the more likely it is that you'll eventually run into that scenario.

The alternative is to go for a dual-drive box, with the additional expense of a second drive. However, you

won't get one this powerful at this price.

For comparison, the DS216 costs £209.99, and it only runs its processor at 1.3GHz and has just 512MB of RAM. This hardware is closer to the DS216Play in spec, though the DS116 has a noticeably quicker CPU.

A more interesting comparison is with the machine it replaces, the generally well-received DS115. That only had an 800MHz processor and 512MB of RAM, making the DS116 a significant upgrade.

The other difference is that the DS115 had two USB ports, only one of which was USB 3.0 spec, and it also had an eSATA port. That's been rationalised into two USB 3.0 ports, which given the popularity of USB 3.0, is logical.

This all makes the DS116 very punchy by single-drive NAS standards, although I wouldn't recommend this as a transcoding engine for the likes of Plex, because it just doesn't have the right silicon for that job.

But for general file serving, personal cloud services, security camera storage and a dozen other jobs, this is a very worthy piece of kit.

mm Mark Pickavance

Blistering quick single drive NAS box



BUYER'S GUIDE

Smartwatches

So far, smartwatches haven't really taken off, but sales are slowly starting to pick up, and prices are falling too. Whether you want one for notifications or just so you can show off down the pub, now is a great time (pun intended) to invest in one of these handy devices.

There are loads on the market, of course, but to give you a taste of what's available, we've selected a few that stand out and which we think could be right for you.

Smartwatches

Apple Watch Sport

DETAILS

- Price: From £259
- Manufacturer: Apple
- Website: goo.gl/omafwK
- Requirements: iPhone 5 or later, iOS 8.2 or higher

The Apple Watch wasn't the first smartwatch to be released, but just like the iPhone and iPad, it was certainly the most highly anticipated before it hit the market. Reports late last year also suggest it convincingly outsold its competitors by claiming more than half the market, despite falling well short of Apple's predicted sales of 40 million.

And while the figures for smartwatch sales differ wildly depending on which analyst company is providing them, even if these differences are taken into account, the Apple Watch seems to be the one to beat.

Undoubtedly, the relative success of Apple's device owes a lot to the introduction of the Watch Sport. This isn't made from the same premium materials as the regular Watch, which means it also doesn't come with the same ridiculous premium price. That said, the Watch Sport isn't cheap, of course, with a starting price of £259, but it's at least competitive with the rest of the smartwatch market. The regular Watch prices start from £559, which is crazy when you consider that it does exactly the same things as its cheaper stablemate.

Whether you opt for a Watch or Watch Sport (both available in 38mm and 42mm sizes), you get a heart rate sensor, an accelerometer for gesture control,

a gyroscope, an ambient light sensor, a speaker, a microphone, 802.11n wi-fi, Bluetooth 4.0, IPX7 water resistance, NFC, a 520MHz Apple 1 processor, 8GB of storage, 512MB RAM and a Retina display with Force Touch. This last feature is particularly useful, because it allows the WatchOS operating system to sense how much pressure you put on the screen when you touch it.

You'll find this same technology used in the newer iPhones and some MacBook trackpads, and it enables an interactive layer that wouldn't be otherwise possible. A gentle tap on the screen while in an app will be treated differently to a hard press, with the latter doing things like bringing up secondary menus or access to other hidden features.

In terms of software features, out of the box you get apps for messages, email, calendar, activity and even phone calls. Of course, the majority of the Watch's features require you to pair it with an iPhone, which means spending even more if you don't have one, but assuming you already own one of those, you shouldn't be disappointed with the experience. Syncing the two devices is simple, and things like notifications work well, with the watch giving you a gentle but

not easily missed tap on the wrist when you have a new message, call or email. Its fitness features are also well presented and easy to use, taking advantage of the various sensors of the Watch.

You can also download more apps for the Watch, and with it being an Apple device, there's plenty of support from third parties.

Predictably, however, the battery life isn't great, lasting a maximum of 18 hours (according to Apple), but the magnetic charging cable at least makes it easy to give the Watch a boost. Of course, this does mean you'll need to take the cable with you wherever you go or buy spares for when you travel. Being an Apple product, these aren't cheap, coming in at £25 each. And if you want an official charging dock, that will set you back £65.

The price, of course, is always going to be a stumbling block, and even though the Watch Sport is more affordable, it's still pricey for what you get. And you'll also be disappointed if you expect the battery to last for more than a day, or if you want to use it without an iPhone. If you can get past these things, though, it really is an impressive device, and it's easy to see why it's a market leader, even if it is overpriced.



Moto 360

DETAILS

- Price: £229
- Manufacturer: Motorola
- Website: goo.gl/XCyzgZ
- Requirements: Phone with Android 4.3 or higher, iPhone 5 or later, iOS 8.2 or higher

When the first-generation Moto 360 smartwatch was released in 2014, its round face helped it to stand out in a sea of rectangular devices. Now, though, the second version of this Android Wear watch isn't the only round smartwatch on the market, so it has to do a lot more to make its mark.

Prices start from £229 (some third-party sellers are cheaper), and for that you get a leather strap; a black or silver case; a black, silver or gold bezel; and two sizes: 42mm and 46mm. The bigger size is for men only, while the smaller version can be used with a men's or women's strap. You can also pay extra for things like a gold case or a metal strap, but even without these things the Moto 360 looks like a high-quality, premium device.

In terms of the internal hardware, you get an ambient light sensor, a heart rate monitor, Bluetooth 4.0, 802.11g wi-fi, dual microphones, an accelerometer, a gyroscope, vibration, 4GB of storage, 512MB RAM and a 1.2GHz Snapdragon quad-core processor.

The performance of the Moto 360 is better than the previous generation, and the design, despite being less novel than it was, is still impressive. If you want a smartwatch that looks like a watch and not a tiny TV strapped

to your wrist, then this is a good option for you.

And not only does it look good, it's comfortable to wear too. The inclusion of a leather strap even for the entry-level model is certainly a significant contributing factor here.

In use, you'll find the upgraded processor means the operating system runs more smoothly than the previous model. As with other Android Wear watches, you can view notifications from your phone, view messages and so on, as well as controlling certain

features with physical gestures. Plus you get the Moto Body app, which is Motorola's fitness app. With this, you can track steps, calories burned, your heart rate and more.

Of course, you aren't limited to what comes with the watch itself; there are plenty of third-party apps you can download from Google Play too, which hugely increases the watch's usefulness. And a lot of these apps can now be used with wi-fi, meaning you don't need to have your phone with you for the Moto 360 to be worthwhile.

Speaking of phones, it's also worth bearing in mind that Android Wear is now compatible with iOS. You won't get the same level of functionality as with an Android phone, but it's enough to mean that iPhone owners aren't limited to just Apple wearables.

If we're going to criticise the Moto 360, then the battery life would be an obvious place to start. It's better than other watches, including the Apple Watch, but you'll still need to charge it at least every two days. This isn't unusual for a smartwatch, but it's still a problem that manufacturers desperately need to solve.

The Moto 360 has also been criticised for its 'flat tyre' design. That's because a small segment at the bottom of the screen is taken up by a black 'shelf', as Motorola refers to it. This actually hides a lot of the sensors, and putting them here allows the watch to have a particularly thin bezel. Personally, it doesn't bother us, and it seems like a reasonable compromise, considering the functionality it provides. Nevertheless, it's worth considering if you have your eye on the Moto 360.

Provided you don't mind this relatively small problem, this watch should definitely be high on your list if you're after a smartwatch.



Smartwatches

Sony SmartWatch 3

DETAILS

- Price: £99
- Manufacturer: Sony
- Website: goo.gl/XSTR5Y
- Requirements: Android 4.3 or higher, iPhone 5 or later, iOS 8.2 or higher

There are many different smartwatches on the market, with various features and designs, but one characteristic is common to almost all of them: they're expensive. Apart from unbranded Chinese imports and basic fitness bands, the vast majority of smartwatches cost in excess of £150. At £99, then, the SmartWatch 3 is a relative bargain, even if it is coming up to two years old.

Of course, that's not the official price. Head to the Sony store, and you'll find the SmartWatch 3 costs £189, which is still cheaper than many competing watches, but not quite so impressive. There is a version with a steel casing and strap, which costs a fair bit more, but if you don't mind cheaper materials, then this watch can be bought from high-street stores like Argos for less than a hundred quid.

As an Android Wear device, you get the usual kind of features, like notifications, email and messages, as well as compatible apps from the Google Play store.

This is all par for the course, really, but what's more notable about the SmartWatch 3 is the inclusion of GPS, which is particularly useful for fitness apps. Other smartwatches do well in this area, but it's clear that Sony's entry is pitching

itself as an exercise companion as much as a smartwatch. It's odd, then, that it doesn't feature a heart rate monitor. However, the accuracy of this feature in other watches isn't always fantastic, so perhaps it's no great loss.

Other than the GPS, the SmartWatch offers 4GB of

storage, 512MB of RAM, a quad-core 1.2GHz Cortex A7 processor, 802.11g wi-fi, Bluetooth 4.0, NFC, an accelerometer, a gyroscope, a compass and a 1.6" multi-touch screen. It's clearly no slouch, in spite of its budget price.

Its IP68 water resistance is handy, but as with any

smartwatch, it would be best to keep it away from all but the most gentle of splashes.

Sony states a maximum battery life of two days, which is relatively good, especially for an older, cheaper device. To charge it, you use a standard micro-USB cable, which is welcome, but the USB port on the watch is located on the back of the watch, down in one corner, making charging far more fiddly than it should be. Nevertheless, the fact you can charge this watch anywhere without having to take special proprietary equipment with you is definitely a plus point.

Is the Sony SmartWatch 3 anything special? No, but it does possess a good deal of the features of more expensive watches, and although it's not a particularly good-looking device, it's not terrible either. The display doesn't have the kind of viewing angles to match up to things like the Apple Watch, but it's good enough for the job.

And that ultimately is indicative of what you get with the SmartWatch 3. It doesn't really excel in any way, compared with other devices on the market, but it offers a lot for the price. If you're on a limited budget, then this could well be the wearable for you.



Pebble Time

DETAILS

- Price: From £90
- Manufacturer: Pebble
- Website: goo.gl/TDTUWO
- Requirements: Android 4.3 or higher, iPhone 5 or later, iOS 8.2 or higher

Cast your mind back a few years, to 2012, and you might recall the Kickstarter campaign for the first Pebble smartwatch. Unlike devices from the big manufacturers, this funding method meant the Pebble had a guaranteed userbase long before it was even launched.

But that's the only thing the Pebble did differently. It also set itself apart by using an E Ink display, rather than an LCD screen. Obviously, such technology severely limits what the Pebble can produce, but the advantage is significantly better battery life, as well as a lower price.

With the Pebble Time and the Time Pebble Round (which has an identical spec, but a round body), you again get an E Ink screen, but rather than the monochrome display of the original model, it's now capable of displaying 64 colours. Clearly, you're not going to be watching any movies on this thing or enjoying your photo collection, but it's enough to brighten things up a bit.

Best of all, of course, the battery lasts about a week, which is much more than you'll get from a watch with an LCD display. That's a massive advantage, no matter how you look at it.

Like the previous Pebble, the Time pairs with an



“ Another plus point for the Pebble Time is it's water resistant up to 30 metres ”

Android or iOS app using Bluetooth. As well as notifications and so on, this enables you to control the music on your phone using the watch, and do things like responding to text messages, making voice notes, getting

Google Maps directions and more. And in spite of running a proprietary operating system, Pebble OS 3.0, there's a decent selection of third-party apps available too.

In term of hardware, you get an accelerometer, an

ambient light sensor, a compass, a gyrometer, a magnetometer, a pedometer, Bluetooth 4.0, a 100MHz Cortex M4 processor and 16MB of storage. It's no speed demon, but this kind of spec is more than adequate for such an undemanding device.

Another plus point for the Pebble Time is it's water resistant up to 30 metres, meaning you can wear it while swimming or in the bath. This is another significant tick in the Pebble's favour, but do bear in mind that it only applies to the regular Pebble Time and not the Round edition, which has a lower IPX7 waterproof rating. The battery life of the Time Round has also been reduced to around two days, but it's a much slimmer, more attractive design than its squarer brother.

You'll also find that many apps that aren't available for the Round model, which is disappointing, because it does look much better. For the sake of this buyer's guide we're giving a score only for the regular Pebble Time, but if you don't mind more frequent charging and a smaller selection of apps, then do give the Pebble Time Round some thought.



Smartwatches

Samsung Gear S2

DETAILS

- Price: £214 from Amazon.co.uk
- Manufacturer: Samsung
- Website: goo.gl/KBQ3BG
- Requirements: Phone with Android 4.4 or higher and more than 1.5GB RAM

Android has been very good to Samsung over the years, but the Korean firm has made no secret of its desire to break free from Google's operating system. The result is Tizen, an open-source OS born from a collaboration of Samsung, Intel and others.

So far, Samsung has limited Tizen phones and tablets mainly to India, but its presence in the European market is set to increase. And if you look beyond phones and tablets, you'll see it's been with us for quite a while already, including, of course, in Samsung's smartwatches.

Clearly, Samsung has a lot of faith in Tizen and, to be fair, it's not entirely unjustified. Finding your way around the operating system is delightfully simple, and central to this is the Gear S2's rotating bezel. Although this watch does have a touchscreen, it doesn't overly rely on it. By twisting the bezel, you can navigate menus easily, without your sausage-like digits getting in the way. This, along with the home and back buttons, makes sense for a device with such a tiny screen.

As you might have guessed, though, Tizen doesn't have the kind of app support as Android or iOS, but this isn't

a deal breaker. The fact is that the smartwatch app market for all operating systems still has a long way to go, and as long as you have all the basic functionality you need, then it doesn't make a huge difference which OS you go for. Also, Samsung's watches work with Android phones, with iOS support expected to be added later soon.

The Gear S2 comes with a 1GHz dual-core ARM Cortex A7, 512MB of RAM, 4GB of storage, an ambient light

sensor, 802.11n wi-fi, dual microphones, a heart rate monitor, Bluetooth 4.0, IP68 waterproofing, a pedometer and more.

This is all generally similar to other smartwatches, and so too is the price. Currently, you can pick this watch up for £214 from Amazon, but prices vary, going right up to around £300.

The 1.2" Super AMOLED display is nice and sharp too, with its 360 x 360 resolution making for a 302dpi pixel density that gives the Apple



Watch a run for its money. Combined with an attractive round design, wireless charging and relatively thin body, this makes for an appealing device.

Unfortunately, the battery life of the Gear S2 lets it down a bit. It's supposed to last between two and three days, but like most battery statistics claimed by technology manufacturers, this figure depends on 'ideal' or 'normal' use. If you're playing around with apps every ten minutes, it's going to run out of juice considerably faster. This, of course, is a problem that all smartwatches (apart from E Ink models like the Pebble) suffer from, so it's not something we can specifically hold against the Gear S2.

It does have its problems, of course, and they stem largely from Samsung's desire to do things differently. But it's also true that this same approach is what makes the Gear 2 so appealing. No, you don't get the familiarity of Android or the same kind of app support, but by rejecting a one-size-fits-all design, Samsung has given itself more freedom to streamline the user experience. If you can forgive its small problems, then the Gear 2 is well worth a place on your wrist.



LG Watch Urbane

DETAILS

- Price: £175
- Manufacturer: LG
- Website: goo.gl/FEGYUB
- Requirements: Android 4.3 or higher, iPhone 5 or later, iOS 8.2 or higher

Another Android Wear device, the LG Watch Urbane is soon to be succeeded by a second edition model, which was recently released in the US after an initial delay. If you want the very latest tech, then you might want to wait for that, but if you're prepared to accept last year's, then you'll benefit from a significant price cut here. Available for around £175 (from Amazon), the Watch Urbane is a far more appealing option than it was when it cost around £300.

This price drop was probably inevitable, though, because the specification of the Urbane is remarkably similar to other Android smartwatches. You get a 1.2GHz Cortex A7 processor, 512MB of RAM, 4GB of storage, 802.11n wi-fi, Bluetooth 4.0, dual microphones, an accelerometer, a heart rate monitor, IP67 waterproofing and a pedometer. It doesn't have GPS, which isn't a huge loss, but what's more unusual is the lack of an ambient light sensor, which almost every other smartwatch on the market possesses. Without this, you have to manually adjust the screen brightness when you want to find the optimal setting for your environment. Considering the high price of this watch, this is a bizarre

omission, particularly as it could have a negative impact on the battery life, which is already inevitably going to be a problem.

On the plus side, the battery isn't as terrible as some of the competition, lasting around two days under light use and about a day and a half if you play with it a bit

more frequently. Realistically, though, you're still going to be charging it every night if you don't want it to run out of power unexpectedly, but thankfully the magnetic charging cradle makes this quick and simple.

As an Android Wear watch, the interface of the Urbane is pretty much the same as every

other smartwatch that runs this OS. The familiarity of this operating system is welcome, but it also has something of a limiting influence too. This is something that affects all Android Wear devices, of course, and LG has added a few of its own apps to the Urbane, but they're pretty basic and don't really add much to the experience.

The important thing, though, is that you receive clear notifications for messages, emails and so on. And because it has wi-fi, you can access some things even when the Urbane isn't connected to your smartphone.

Like other smartwatches, the Urbane is a chunky fella, but arguably, it still looks better than squarer devices like the Apple Watch. This is important, because the physical design of this watch was always one of the key reasons for considering it. Now that the price has dropped, it's more competitive in other areas too, but its looks remain central to its appeal. It has a much fatter bezel than the Moto 360, but if you can't stand the 'flat tyre' look, then the Urbane wouldn't be a bad alternative. And if the Gear S2's Tizen OS puts you off, then once again LG's watch would be ideal.



Summary

The relatively modest sales of smartwatches in general suggest that perhaps the world doesn't want them, but that's not quite right. There's plenty of interest in this market, as demonstrated by the successful Kickstarter campaign of the Pebble. But a couple of factors have limited their appeal.

Their high prices, obviously, is one problem, but that's natural for a new technology. As sales pick up, smartwatches will slowly become more affordable. Indeed, right now we're at a point when you can pick up a decent device for less than a hundred quid, which is a good sign for the future.

And the prices become smaller, hopefully so will the devices themselves. Right now, they're still quite large, which has put off many prospective buyers, but newer models are slimmer, which will no doubt make them more appealing.

Unfortunately, though, making smartwatches smaller is somewhat counterproductive when it comes to probably their biggest limitation: battery life. Although battery technology is slowly improving all the time, one thing we can't see improving dramatically any time soon is battery life. It's annoying enough that our phones now need to be charged daily. And although most of us are now used to this, smartphones can be considered as almost a necessity, while all smartwatches offer is visual appeal and the very slight convenience of not having to take our phones out to view messages.

Sadly, this is likely to be something that you'll just have to get used to. Provided you can, though, now is probably a good time to invest in a smartwatch, whether it's one of last year's models or the next-generation devices due this year.



▲ So far, smartwatch designs have fallen into two main categories: those that look like watches and those that look like technology. Either way, the biggest problem they all face (apart from the Pebble) is short battery life

	Apple Watch Sport	Moto 360	SmartWatch 3	Pebble Time	Gear S2	Watch Urbane
Operating system	WatchOS	Android Wear	Android Wear	Pebble OS	Tizen	Android Wear
Processor Speed	520MHz	1.2GHz quad-core	1.2GHz quad-core	100MHz	1GHz dual-core	1.2GHz quad-core
Storage	8GB	4GB	4GB	16MB	4GB	4GB
RAM	512MB	512MB	512MB	-	512MB	512MB
Graphics	PowerVR SGX543	Adreno 305	Adreno 305	-	Mali-400MP2	Adreno 305
Screen Size	1.65" or 1.5"	1.56"	1.6"	1.25"	1.2"	1.3"
Screen Resolution	390 x 312 or 340 x 272	360 x 330	320 x 320	144 x 168	360 x 360	320 x 320
Pixel Density	302ppi or 290ppi	233ppi	283ppi	182ppi	302ppi	245ppi
Wi-fi	802.11 b/g/n	802.11 b/g	802.11 b/g	n/a	802.11 b/g/n	802.11 b/g/n
Bluetooth	v4.0, LE	v4.0, LE	v4.0, LE	v4.0	v4.1	v4.1, LE
Battery	250mAh or 205mAh Li-ion	400mAh Li-ion	420mAh Li-po	150mAh Li-ion	250mAh Li-ion	410mAh Li-ion

They came, they saw, they
conquered, then they closed down...

Top 10 Tips For Weather, News, And Money

The conclusion to Roland Waddlove's top tips series covers several additional Windows 10 apps

1 Weather News

The News app is the obvious place to go to find the latest news, but there is also a news feed in the Windows 10 Weather app. You might expect it to feature weather forecasts, but it is broader than that and has some interesting stories from a variety of sources around the world. Select 'News' in the left panel and there are news stories about current events like storms, floods and bad weather, but also general articles like air pollution in the world's cities, drought around the world, the best weather photos of the last month, coral bleaching on the Great Barrier Reef, volcanic eruptions and more.

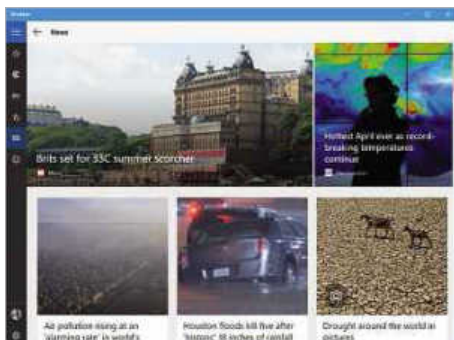
2 Weather Favourites

With summer coming up it is useful to add locations to the Weather app and monitor the forecast. For example, if you frequently visit a beach, go walking in the Lake District or cycle through Dartmoor, you can add these locations to the Weather app. When you are next planning a day out, you can quickly view

the forecasts for all these places and see where is the best one to visit. Click Places on the left in the Weather app and click the plus tile under Favourite Places. Enter the name of a town, place or post code and then click the place in the list of suggestions. Repeat this for as many places as you want.

3 View Historical Weather

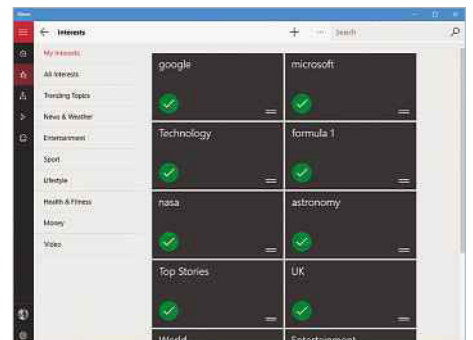
The Weather app not only displays the forecast for the next few days, but also historical weather. This can be combined with the previous tip to get historical weather forecasts for your favourite places. You can find out which month is usually the warmest, the wettest or the driest. Go to Places on the left and click a favourite place, or enter the city or post code in the search box. Then when the weather forecast appears, click Historical Weather on the left. Use this feature when planning holidays abroad to work out the best time to go for the sun and to avoid the rain. You can see average high and low temperatures, and average rainfall.



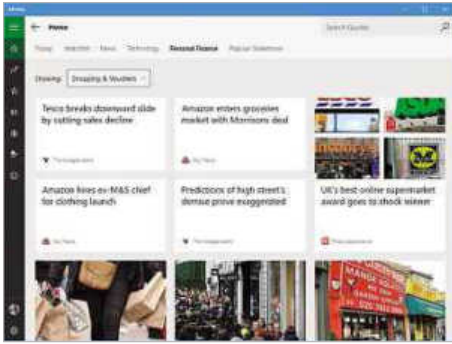
▲ The Weather app's news feed has general weather-related stories from around the world



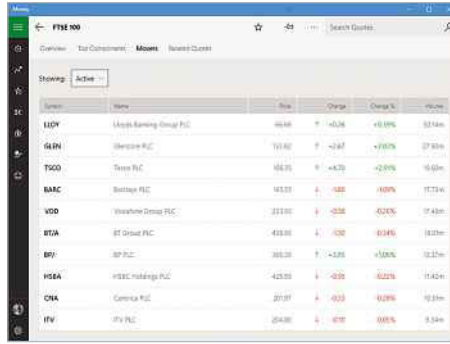
▲ The Weather app can show historical temperatures and rainfall anywhere in the world



▲ Drag the interest tiles around to determine the order of news stories in the News app



▲ In the Money app, select Personal Finance and then a news category in the list



▲ Get detailed financial information on a company in the Money app



▲ Track companies you have shares in and see how they are performing in Money

4 Create A News Channel

You can create your own news channels in the Windows 10 News app in order to follow topics that interest you. Start the News app and enter any word or phrase into the search box in the top right corner. News stories related to that word or phrase are displayed, and to the left of the search box is a star icon. Click it to add this to your interests. Repeat this for other topics.

The home screen of the News app is made up of news stories for all your interests. To focus on just one of these, click Interests on the left, select My Interests and then click the tile with the topic you want. Only news stories matching the interest on the tile you click are displayed. Add your favourite football team or sport, your favourite music artist, and so on..

5 Customise Your News Feed

In the previous tip we showed how to add your own interests to the News app. The news stories on the home screen are displayed in the same order as your interests. There is one story per interest and they can be arranged into whatever order you prefer. For example, if you place your favourite football team first in your interests movie news second, and health third in your interests, the news feed will feature one story on each in that order.

Click Interests in the left panel in the news app. If you have not yet added many interests, select each category and click the plus symbol on tiles you want to add. Select My Interests on the left and your interest tiles are on the right. Click the double bar in the bottom right corner of each tile and drag it and drop it where you want it to appear in the news feed.

6 Read Local And Foreign News

The News app is the easiest way to read local news on the internet. Just click the Local button on the left. While viewing local news stories, click the Change Location button at the top of the News app and enter any city. Select it in the list of suggestions and local news stories are listed. The News app is available in several international editions and you can choose the one you want by clicking the settings icon in the bottom left corner. Select an edition from the list, such as UK, US, France, Australia or whatever part of the world you are interested in.

7 Read Money News

You can view financial news in the News, but Money has a wider variety of topics. Open the Money app and the home screen displays a stream of money-related news stories. A menu bar across the top enables you to focus on money stories about technology or personal finance. There is also a News category in addition to the home screen general news.

Click the gear icon in the bottom left corner to open the settings and you can choose the international edition. If you have an interest in US financial news stories, you could select the US edition. Also in the settings is an option to display breaking news alerts. Turn this on and if an important story breaks, you will see a notification on the screen.

8 Explore The Money Markets

Click Markets on the left in the Money app and you can explore the world financial markets. Across the top is the FTSE 100, DOW and DAX market information. Click each of these to see detailed information like the FTSE 100 stock market index, and a chart that can show today, the last week, month, year, or five years. The information is live and if you stare at it for few minutes it will change. News stories related to the stock market selected are displayed below the chart. Click Markets on the left, World Markets on the right and a world map containing all the major stock exchanges is displayed. Click one to view the latest information and charts.

9 Get Company Information

The markets part of the Money app is a maze of links and it is easy to get lost, but there is a lot of great information available. Click Markets on the left, FTSE 100, then Top Components or Movers to see a list of companies. This is great and it shows the current share prices, the change, volume, and more. Click a company and you can view detailed information, including a chart of the share price over the day, week, month, year, and related news stories. It is great if you are planning investing in a company's shares.

10 Build A Watchlist

If you have shares in a company or are thinking of buying them, you will want to watch them. The Money app enables you to build a watch list so you can keep an eye on companies. Click Watchlist on the left and then click the plus button at the top. Enter the stock market symbol or the company name and then click it in the list of suggestions. It is added to the watchlist. Repeat this for other companies you want to follow.

The watchlist displays important information like the share price and whether it is up or down for the day. Below are news stories related to the companies in your watchlist. Click a company to see detailed information about a company, like its live share price chart, historical prices, opening and closing prices and more. Click Key Statistics at the top and you'll see even more information, such as charts showing growth, profitability, financial health, and management effectiveness. There is a wealth of data for the financial investor. [mm](#)



Sarah Dobbs finds all the apps and programs you need for everything podcast-related

It's hard to pinpoint the moment when podcasts went from being a niche interest to a standard part of the media landscape. Was it when President Bush's radio broadcasts got an online feed in 2005? When Ricky Gervais launched *The Ricky Gervais Show* in 2006? When Kevin Smith launched his *SModcast* in 2007? It might even have been as recently as 2014, when Sarah Koenig's *Serial* became the new thing you had to keep up to date with in order to keep up with the conversation in the pub.

Whenever it was, though, it's definitely happened. Someone with headphones plugged in on the train or at the gym is as likely to be listening to a podcast as to music, and it's a safe bet you know at least one person who hosts their own online show. Podcasts, like TV boxsets and Netflix originals, are now a pretty essential part of your media diet – which means you're going to need some podcast apps!

The apps listed here are separated into a few categories: for listening to, discovering or making your own podcasts. You won't need them all – at least not immediately. But if you need a better way to organise your podcasts or you're considering taking the plunge and launching your own, here are the apps you should be checking out...

Listening

iTunes

Platform: iOS, Windows

Price: Free

It's obvious, but iTunes is a pretty good place to start listening to podcasts – assuming you want to listen on an iOS device or on your PC. iTunes' Podcasts tab lets you browse and search for podcasts, and then you can listen, download or subscribe to them. You can also choose to sync podcasts to your iOS device in a couple of different ways, so you can either manually choose which episodes you want to load up, or you can let iTunes handle it, automatically adding new episodes and removing ones you've listened to.

iTunes has been around long enough now that you'll probably know whether you want to use it or not; it can be temperamental, especially if you're syncing between more than one computer. But it does aggregate most podcasts out there, so whatever you're looking for, you'll probably find it in the Store, and it's easy to see what you have and haven't listened to. Handily, it will also automatically stop downloading new episodes of a podcast you've been neglecting, so you won't keep storing up hundreds of unwanted episodes of something you're unlikely to want to listen to.



Overcast

Platform: iOS

Price: Free

Beyond iTunes, the next best podcast app for iOS devices is Overcast. It's a cloud-based podcast app, which syncs with iPads, iPods and Apple Watches so users can access their podcasts on the move. New episodes are auto-synced, and the app also keeps track of what you've listened to, so you can switch between the browser version and your phone on the commute home without missing anything.

There are all sorts of other advanced features, including the ability to create a prioritised list of podcasts you're interested in, a normalising function to level out the volume in shows

(pretty handy, considering that most podcasts aren't professionally recorded and often have participants who speak more loudly than others!) and even the ability to truncate silences. All of that means Overcast users can make sure they're always listening to the podcasts they're most interested in and that they're actually getting to hear better versions of them than everyone else too. And if you're a podcast newbie and need some recommendations, Overcast has that covered too.

The only downside, really, is that there's no Android version and never will be: developer Marco Arment says he's not interested in non-Apple platforms. Sorry, fellow Android users.

Pocket Casts

Platform: iOS, Android, Windows

Price: £2.99 for the iOS app; £2.49 for the Android app; £2.69 for the Windows app

Google just added a podcast function to its Play Music app, but only for users in the US and Canada at first, which means Android users will have to look a bit further afield for the time being. It seems strange that Android is so underserved for podcast-related apps in comparison to Apple users, but that's a battle for another time. For now Android, iOS and Windows users alike can use Pocket Casts.

Like Overcast, Pocket Casts is jam-packed with features aimed at making your podcast-listening life easier. It has silence removal and voice-boosting functions; you can set podcasts to auto-download when you have a wi-fi connection, to save you using up your data allowance; and it even has a sleep timer built in so you can drift off listening to a podcast and let Pocket Casts turn it off for you.

It's so feature-rich, actually, there probably isn't room here to discuss everything it has to offer. But it is worth mentioning that it has a few special features for handling video podcasts – you can set them to audio only if you're listening in your car or throw them to your TV if you have a Chromecast. The main drawback is that it isn't free but, in fairness, it's under £3 whichever platform you want to use it on, which probably won't break the bank.



Discovering

Spreaker

Platform: iOS, Android, web

Price: Free

The Spreaker app lets you download and listen to podcasts, of course, but it's also very much geared towards helping you find new things to listen to. You can search, but Spreaker also has its own editorial staff who make recommendations and put together regular playlists, sorted by category. So if you're looking for a new technology-related podcast to listen to, you can check out the Tech channel and maybe find a new favourite there.

The Spreaker platform also allows for live broadcasts as well as pre-recorded episodes, which makes the whole thing feel a bit more current and exciting, and it's also interactive, with the app encouraging listeners to leave feedback. There's a definite community feel to this app, and the most popular podcasts are also highlighted for your convenience. Basically,





instead of searching for podcasts and making your own playlists of episodes, you could just pick a topic and let Sreaker do the legwork for you. Maybe you won't like everything it shuffles up, but at the same time, it's a great way to discover new podcasters and hear stuff you might never otherwise have come across.

If you're feeling inspired. Sreaker also has a 'Create' tab, where you can make and publish your own podcasts.



Player.fm

Platform: *Android, Kindle, web*

Price: *Free (for now)*

Player.fm could have been included under the Listening section here, because it's a pretty good alternative for Android users. But like Sreaker, the reason it's here instead is because of its emphasis on discovery. Via either the app or the Player.fm website, you can find podcasts on various topics, from fitness to personal finances to bedtime stories (yes, really). You can also check out what's currently popular or what's trending; you can also filter by country and language, in case you've ever wondered what South African podcasters make of the news or if you're learning a new language and want to listen to some native speakers.

Again, you can let the app do the discovery work for you by picking a topic and letting it put together a playlist;



Player.fm reckons it has more than three million podcast episodes available, which ought to keep you going for a while. It's another cloud-based player, so you can sync to various devices seamlessly and also only download the episodes you want when you want them. Do watch out if you're downloading over your mobile data connection, though: unless you have an unlimited package, you could run into trouble downloading too much audio.

Although it's already pretty good, Player.fm is planning to launch a Gold version of the app later this year; it'll be a paid upgrade, with even more features available.

Stitcher

Platform: *iOS, Android, Kindle, web*

Price: *Free*

Another option is Stitcher. Founded in 2008, it's one of the longest established and best known podcast platforms, and again it has plenty of options for discovering new content. You can see lists of the top podcasts and their top episodes through the website or app; you can subscribe to curated playlists (or make your own); and Stitcher will also recommend new things for you to listen to based on what you've already listened to and what other people with similar interests have gone on to download. The lists of recommended content go into truly niche interests; there's one for vegan-friendly podcasts and another of recommended listens for 'people who don't get podcasts'.



Again, it's a streaming model, though you can't download episodes onto your device, just stream as you go – so again keep an eye on how much you're downloading and what kind of data connection you're using to do it. On the plus side, Stitcher also aggregates live radio shows, so there will always be something new to listen to. Not that it's likely you'd ever get to the end of the thousands of hours of audio it's already got lined up for you.

Making Your Own

Audacity

Platform: Windows, Mac, Linux

Price: Free

Okay, so you can't use Audacity on your iPad or Android phone. But if we're talking software for recording and editing podcasts, we can't not mention Audacity. It's free to download and available whatever operating system you're using. You can record directly into Audacity or import recorded files in to edit. And while audio editing might seem terrifying and complicated at first, it's actually pretty simple. Audacity has plenty of power under the hood, but you can just ignore the options you don't need and just stick to cutting bits out and adding bits in, if that's all you want to do.

If you do want to do more, there are plenty of effects that you can add or tweak. Most useful for making your podcast sound good are the options for fading audio in and out, normalising the volume across the entire podcast (yes, some of the listening apps will do that, but it's probably best to get it sorted before you upload your audio!) and removing background noise. Because Audacity is such a widely used piece of software, you can also find tutorials and instructions for doing anything you might want to do all over the internet. Audacity is pretty ubiquitous in podcast editing circles and for good reason: it's just so good you're unlikely to ever want to pay for another option.



Ferrite Recording Studio

Platform: iOS

Price: Free for the basic version; £7.99 to upgrade

If you really do want to edit your podcast on a mobile device (and you have an iPad or iPhone), then Ferrite Recording Studio might be your best bet. Recording is straightforward and on-screen recording meters should flag up any volume issues. (Professional podcasting types will tell you that you need a proper microphone to record, but if you're just making something for fun, the microphone on your iPhone should be good enough, assuming everyone's in the same room.)

Editing, too, is pretty simple. You can zoom right into parts of the waveform for snipping out mistakes, rearrange clips and mute bits as necessary. You can also add bookmarks to flag up specific parts of the audio, which is handy if you want to remember at which point you said something particularly brilliant.

Downsides? Well, the basic version of Ferrite is free, but to get unlimited recording space and extra editing features, you'll need to pay £7.99 to upgrade. And there's no Android app. Grrr.



Soundcloud

Platform: iOS, Android, web

Price: Free to download; pricing plans available

Once you've created a podcast, you're going to want to share it with the world. Maybe the easiest way to do that is via Soundcloud: it's free to sign up for a basic account, and that lets you upload up to three hours of audio before you'll need to pay to upgrade (£75 a year gets you unlimited upload space).

Basic accounts also have access to basic listener statistics, so you can see how many people have listened to your podcast through Soundcloud; you'll need the Pro version for more detailed stats, including how many people have listened through an RSS feed. That's annoying, because it gives an incomplete picture of your stats to casual visitors. But it is pretty straightforward to get your podcast listed in iTunes, which is probably where you'll need it to be to get it the most attention.

Another niggle is that you can't upload audio via the iOS app, and you can only upload audio recorded in the Soundcloud Android app via the Android app. Otherwise, you'll need to upload your podcast through the web interface. Still, it's worth a bit of a faff to get your podcast up and available, with a clean, straightforward interface, and all the interactive bits like sharing buttons and comments all handled for you.



Podbean

Platform: iOS, Android

Price: Free to download; various pricing plans available

The final app is almost an all-rounder: you can use Podbean to listen to, discover and publish podcasts. And it's available for both iOS and Android devices, which is nice! The only thing you can't do is edit your podcast, but that's what Audacity is for.

Podbean is probably for serious podcasters rather than dabblers, because while the app is free, you need to pay if you want to upload your own content. Prices start at \$3 (about £2) a month and go all the way up to \$79 (about £54) for podcasts that need a lot of bandwidth (i.e. those with thousands of listeners). But for your money, you do get a swish-looking site for your podcast, detailed analytics and the ability to monetise your podcast.

Yup, Podbean lets you create private podcasts or add exclusive premium content, to make money off your listeners. It also has a crowdfunding platform built in, so you can ask your fans for donations to keep your show on the road. This is where it gets really real, then. It's probably not worth jumping on board if you're making your first episode and not sure how serious you are about keeping up with a regular broadcast, but if you're getting established and want to make a proper go of it, Podbean might be a good bet.



Happy Podcasting

Downloaded any of these apps yet? If you're not already listening to at least half a dozen podcasts on a weekly basis, it's time to catch up; and if you are, maybe it's time to think about making one of your own? Podcasts are basically yet another example of the way the internet has democratised media, making it possible for anyone to publish their thoughts, get their art seen – and make their voices heard. Have fun! [mm](#)

Coding With Raspbian Jessie

David Briddock explores coding options on the Pi's official operating system

Raspbian is the official operating system of the Raspberry Pi. This free Debian Linux-based distribution embodies over 35,000 pre-compiled software packages, some optimised for the diminutive machine. Recently the Pi Foundation (raspberrypi.org) rolled out Raspbian Jessie, a major update based on Debian Jessie (major Debian releases are named after *Toy Story* film characters, if you were wondering). Changes include visual improvements, new and updated apps and operational modifications. This week, however, we take a look at Jessie's coding options.

Python

Python is the primary development language of the Raspberry Pi. It's been included in the Raspbian operating system since the very beginning, and the latest Raspbian distribution image supports both Python version 3 and the older 2.7 version. Both come with plenty of code examples, too – Python was chosen because of its all round programming flexibility and easy-to-learn characteristics. Its clear and easy-to-grasp syntax is ideal for newbie coders, yet the language is powerful enough to create useful apps in only a few lines of code. What's more, with the interactive console-mode environment you can type in Python statements and instantly see the results.

Because the Python language is free to use and distribute it's found in software companies, research laboratories and academic institutions across the world. Python also runs on just about every

operating system and so can be found on PCs, tablets, smartphones, games consoles and many other small hardware devices.

That means it is popular with Google developers, astronomers, robotics engineers, space scientists, nuclear physicists, bioinformatics researchers and many others too. This popularity has, in turn, resulted in a huge collection of Python library modules that cover almost any coding activity. Text handling, graphics, system utilities, coding tools, simple electronics, autonomous robotics, gaming, real-world science and much more are available to call upon should you require. There's also a large and highly active Python community. They not only contribute to the enhancement of the language itself but have also created thousands of code samples, tips, help pages and 'how-to' videos.

Python 2 Vs Python 3

As we mentioned above the Raspbian Jessie image comes with both the classic Python 2 and the newer Python 3. There are subtle syntax differences between the two, which unfortunately means that code written for one may not run with the interpreter for the other. This certainly isn't ideal because, If you spot a code example or full program listing it might not be immediately obvious whether it's aimed at version 2 or version 3. This problem is compounded by the fact that quite a few Python 2 library modules, including some very popular ones, haven't yet been converted to work with Python 3.

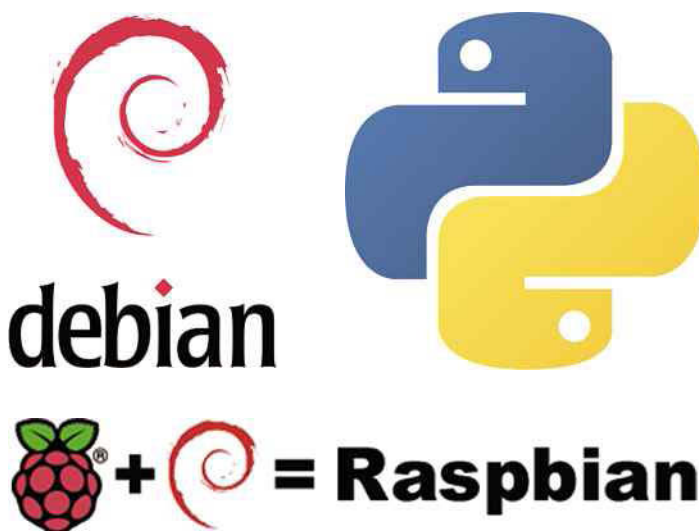
The best advice for newbies, however, is to start with Python 3. The reason is simple: version 3 is the future of Python. Slowly, but surely, all the popular library modules are being converted – and, as time goes by, support for version 2 will just as surely diminish.

Python Library Modules

There's hundreds of Python library modules. Each one containing domain-specific functionality aimed at greatly simplifying the coding process. Import the right library module and you can create mathematical equations, graphical user interface (GUI) apps, turtle graphics, 2D and 3D animations, fully-featured games, social media apps and even machine learning systems.

Preinstalled Python library modules provide support for the General Purpose Input Output (GPIO) connector and the official camera module. These days GPIO programming is made even easier with the GPIO Zero module. Written by Ben Nuttall (bennuttall.com) you can now switch on an LED now takes just two lines of code (pythonhosted.org/gpiozero).

If games are your passion the Pygame Zero library module (pygame-zero.readthedocs.org) is also preinstalled on Jessie.



▲ *Jessie Programming Menu*

With its simplified set of Python statements it makes game coding easier, faster and more fun. This ultimately means that, when you've learnt the basics, you can transfer these skills to the full Pygame library module (pygame.org).

The new Raspbian Jessie image also has enhanced Python support for a selection of popular Pi peripherals. Examples include the circuit board prototyping Explorer and Explorer Pro HATs, plus the multi-functional Sense HAT, which was taken by astronaut Tim Peake to the ISS as part of the Astro Pi project (see boxout). There's also support for popular add-on boards like the Pibrella, PiFace and PiLite.

Scratch

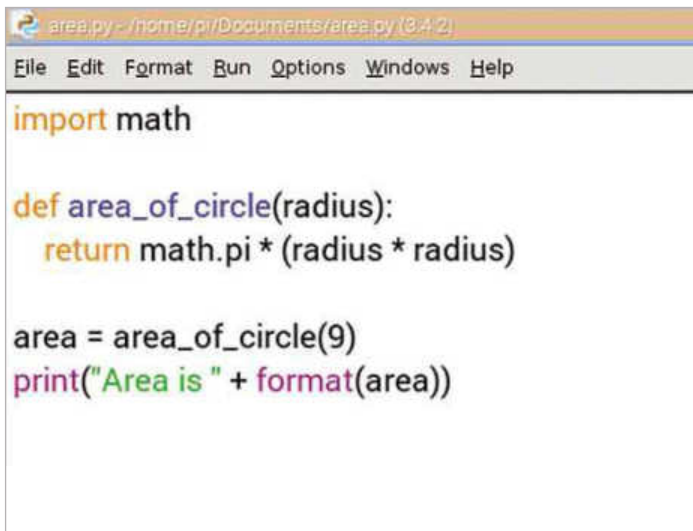
With Scratch you can construct all kinds of multimedia projects without writing a single line of code. Scratch's highly visual interface is aimed at anyone old enough to use a keyboard and mouse. In fact, you hardly need to use a keyboard at all. Created by MIT's innovative Media Lab (media.mit.edu) Scratch does away with the traditional editor and symbolic language approach. In its place there's a collection of graphical, snap-together programming blocks. Blocks with different shapes that lock together in specific ways. Blocks that handle calculations, data management and multimedia manipulation.

Code Editors

There are a number of code editors pre-installed on Raspbian Jessie. Some are straightforward Linux text editor stalwarts like Vi and Nano. Others, like Python's IDLE and the general purpose Geany, understand code syntax and so feature colour-coded listings, auto-completion, debugging help and general coding assistance.

IDLE is window-based app that comes in Python 2 and Python 3 flavours (docs.python.org/3/library/idle.html). The menu-driven commands make it easy to write, edit, save, test, debug and run Python code. While Geany supports many other languages as well as Python, including C, Java, HTML, XML and PHP (geany.org).

Of course, as Jessie is based on Linux many more editors can be downloaded and installed. However, fully-featured integrated development environments (IDE) need plenty of processing power and so work best on a Pi 2 or Pi 3.



```
area.py - /home/pi/Documents/area.py (3.4.2)
File Edit Format Run Options Windows Help

import math

def area_of_circle(radius):
    return math.pi * (radius * radius)

area = area_of_circle(9)
print("Area is " + format(area))
```

▲ Python 3 IDLE

While Scratch blocks perform a multitude of operations, one fun activity is controlling 'sprites' (animated graphical objects) and sounds. As a quick start you could load sprites and sounds from the code examples provided. Alternatively you could also create something from your own imagination.

Block coding transforms the classic program, test and debug process into a visually attractive, interactive, full-filled experience. And, despite the simplicity of this block building concept, it's possible to build quite intricate and sophisticated programs.

Parents and teachers might like to know there's a ScratchEd online community (scratch-ed.gse.harvard.edu) where people can share stories, exchange resources and ask questions.

Scratch Extras

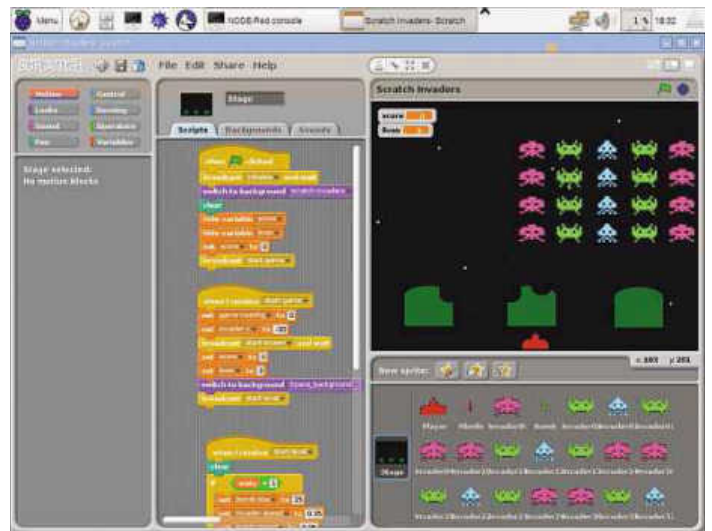
Scratch fans will be delighted to know Raspbian Jessie has a new version of development environment. This version has a number of enticing features. One is increased performance. Under the covers Scratch is built with Squeak, a dialect of the Smalltalk coding language. Major changes to the Squeak implementation and its runtime environment mean Scratch now runs significantly faster than previously.

Another interesting addition is the built-in GPIO server, which simplifies building apps that control the GPIO pins and any associated Pi add-on boards. In fact, this server offers much more than just GPIO functionality. Look at little closer and you'll discover it also allows direct access to the Pi's built-in camera interface and network IP addressing.

With the latest release you can also create your own custom blocks. Once its behaviour has been defined, a new block can be used in exactly the same way as any pre-defined block. This is a great feature for teaching, as a more experienced Scratch developer could create some of these custom blocks, which can then be used to simplify the coding experience for Scratch beginners or their less experienced classmates.

Scratch Extensions

There's another powerful feature in the Scratch armoury: Scratch extensions. These extensions enhance its potential well beyond typical animation and game coding scenarios. Interestingly, an extension is simply a JavaScript app that communicates over the standard HTTP web protocol. These apps typically run on a host machine via the Node.js server. All these elements are open source and free to download, so anyone can try their hand at creating a Scratch extension.



▲ Scratch Space Invaders

Many of these extensions connect the Scratch platform to the external world. One example is the Microsoft Kinect extension (scratch.saorog.com). Developed by Stephen Howell, it captures hand, limb and full-body gestures, then feeds these back to the Scratch developer. Another example is the drone controller extension developed by Camp K12. It is free to download via the GitHub website (github.com/campk12/ScratchForARDrone), which also has full download, install and run instructions. If the AstroPi project captured your attention, you might like to take a look at the International Space Station Tracker extension (khanning.github.io/scratch-isstracker-extension).

It's worth noting that, currently, the Scratch extension capability is only in Beta status. This means that, instead of going to the main Scratch site, you'll need to head over to the ScratchX website instead (scratchx.org) for more information.

Java

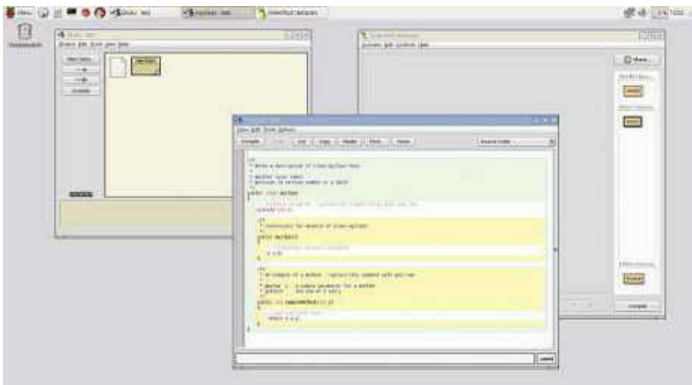
The Java language has been preinstalled on Raspbian Jessie for years now. However, with the Jessie distribution image Java coding fans will notice two new applications in the main menu's Programming category. Called BlueJ and Greenfoot they're both

Astro Pi Code

Tim Peake took two Astro Pi devices, named Ed and Izzy, with him to the ISS. During his six month mission they're being used to measure the living conditions inside the station, reveal how it moves through space and detect the Earth's magnetic field.

The low cost Astro Pi hardware (astropi.org) offers a unique learning opportunity. Last year students from schools across the UK took part in an Astro Pi competition (astro-pi.org/competition) to write scientific Python-coded programs for the Astro Pi.

These programs ranged from a game-like astronaut reaction timer to ISS radiation level monitoring (astro-pi.org/competition/winners). These programs will run inside the ISS European Columbus module, before the results are downloaded back to Earth. A long-term ISS environmental monitoring programme will continue to run these Astro Pi experiments, adding the time-stamped sensor data to downloadable CSV file.



▲ **BlueJ and Greenfoot**

aimed at simplifying the app building experience by offering users a graphical coding environment that mixes mouse-driven design and code generation (as championed by Scratch) with traditional hand-coded statements.

Greenfoot, a joint project by the University of Kent and Oracle, is specifically aimed at introducing a younger coding audience to the concepts of constructional thinking and design. While BlueJ is probably more applicable to those who already have a little coding experience. To get started, try out some of the BlueJ and Greenfoot sample projects that you can find located in the Pi's '/home/pi/Documents' directory.

C

Just like any other Linux-based operating system, Raspbian's kernel code, device drivers, tools, utilities and graphical interface are all written using the C language. A key C advantage is its fast execution speed, something that's important on lower-speed processing chips.

However, learning C is more of a challenge than the other languages we've discussed so far. This is because C code needs to be compiled into an executable file. This intermediary step means it's far less interactive than, say, Python. On the other hand, a compilation step does help to highlight syntax and other coding errors before anything is actually run.

The simplest way to give C a try is to play around with the pre-installed sample C programs. These cover graphics, audio and video. Navigate to the Pi's '/opt/vc/src/hello_pi' directory to find the example C source code with the associated compilation 'make' files plus a couple of helper C libraries.

Sonic Pi

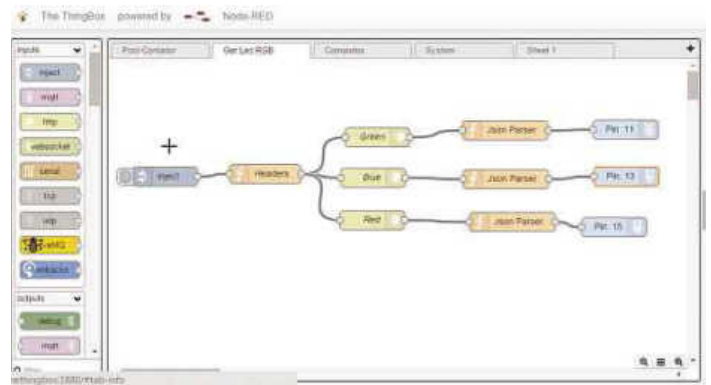
Raspberry Pi owners often use their device to play music. However, did you know that with Sonic Pi you can compose your own unique musical compositions using code?

Created by Sam Aaron (twitter.com/samaaron) at the University of Cambridge, the Sonic Pi homepage (sonic-pi.net) describes the app as, "a free live music coding synth for everyone."

Originally designed to support computing and music lessons within schools, its creative potential has a much wider scope than education. In fact, Sam Aaron himself uses the app on stage for live, code-generated musical performances.

The Sonic Pi scripting language is designed around a set of simple and intuitive music-centric commands. The syntax might look familiar to those with experience of scripting languages like Python. In fact, it's based around another popular programming language called Ruby.

We'd recommend you give Sonic Pi a try. Maybe you'll become the next Kraftwerk, Daft Punk or will.i.am.



▲ **NodeRED GPIO flow**

Node-RED

Node-RED is an innovative, easy-to-use development tool for Internet-of-Things (IoT) devices and low-cost computing boards, like the Raspberry Pi. Created by IBM it's a browser-based tool built on top of Node.js, a popular free-to-install JavaScript server. The user interface has a drag-and-drop flow editor, where you wire together combinations of blocks selected from a palette (see image). Once constructed, a flow can be executed with a single-click.

The palette of nodes can be extended by downloading Node.js modules. With over 120,000 modules in Node's package repository there's huge potential for customisation. What's more, custom block behaviour can be defined using JavaScript functions created with a code editor.

There are loads of Node-RED example flows that include GPIO and camera interaction, web services, social media and Pi Minecraft communication. And you can share your best flows with the world via an online flow library.

To find out more and visit the IBM NodeRED website (nodered.org), which has Raspbian Jessie specific installation steps, operational details and Pi coding examples for you to get started with (nodered.org/docs/hardware/raspberrypi.html).

Have Fun

Whatever language you choose, and whatever apps you create, make sure it's fun. Oh, and please take some time to let us know what you create. Happy coding! [mm](#)

Coding Tips

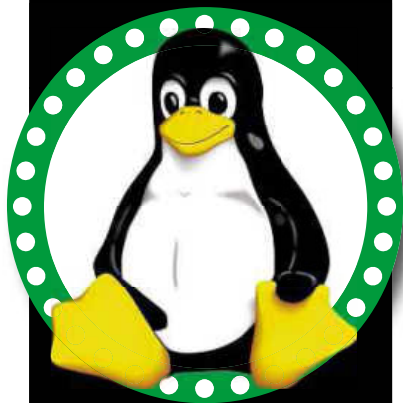
Be clear: Use descriptive names for variables and functions. This ensures the code is far more readable and reduces the need for comments. Remember, as a coder you'll spend a lot of your time reading code.

Don't repeat yourself: Put common pieces of code into functions. This not only makes the program smaller but also much easier to maintain and debug.

Keep it simple: Only write the code necessary to implement the features you have in mind. And ensure functions are small in length and precise in behaviour.

Test frequently: Knowing your app worked fine just 10 minutes ago means it's much easier to identify and fix bugs.

Keep learning: Read books, buy magazines, watch videos, search for code examples and write lots and lots of code.



David Hayward has been using Linux since Red Hat 2.0 in schools, businesses and at home, which either makes him very knowledgeable or a glutton for extreme punishment

Linux

Introducing Lakka

Retro gaming on Linux

It's no secret that we here at Micro Mart are somewhat partial to a spot of retro gaming. Whether it's on the Spectrum, C64, Sega Mega Drive, Arcades, Game Boy or whatever, you can bet we'll be found hiding in the corner with a sneaky game while the editor's back is turned (usually, it's turned because he's playing on something too).

While we were hunting down some high-quality distros for the best retro experience, we came across Lakka. Lakka is a lightweight distro built on top of RetroArch, and it features a PS3-style interface that's compatible with many types of controller.

Not only that, but it's also specially designed to run on a Raspberry Pi, PC, CuBox-I, HummingBoard, Banana Pi, Cubieboard 2 and Cubietruck, with in-development progress for the Raspberry Pi 2 and Odroid-C1.

The setup is simple enough. All you need to do is head to the Lakka site (www.lakka.tv), and click on the 'Get Lakka' button. The site will then take you through a six-step process based on the system you currently have and the system you intend to install Lakka onto.

After a short while, you'll be able to download the tiny image (just 175MB in the case of the PC version), and transfer it to a handy USB stick.

With the stick in the machine and booting from it, you have

the choice to either run a Live version or go through the installer. Whatever you opt for, you'll soon end up with a wonderfully laid out desktop, where you can browse through a huge number of pre-installed emulators.

The instructions go into detail regarding an available Lakka Box, which will come supplied with many ROMs to get you up and running. However, we have a few available (legal, of course) and instead transferred them to our Lakka installation.

The result was pretty impressive, to say the least. The laptop we were testing it on wasn't the latest and greatest, not by a long shot, but it managed to perform magnificently. Naturally, these are old console games, so it should, but running all that through an emulator with its impressive graphical layer on top could take its toll.

Next, The Raspberry Pi

Our next step is to get Lakka installed on a Raspberry Pi and see how everything looks when hooked up to the big screen.

All being well, we should have more to report on in the coming weeks – that is unless we've been spending too much time playing instead of writing, something that I assure you doesn't happen often. Mostly.

Get Lakka

We like Lakka. It's a stable, well organised and presented distro. It's easy to use, and it runs really well on older hardware.

If you're into some retro gaming and you don't have access to the original hardware, then Lakka and an old PC are well worth a look.

Until next time, happy retro gaming folks.

▼ *Retro gaming on Linux? Consider us signed up*



News Updates

Sven Harvey returns with more from the Amiga market

Recursion Computer Fair 2nd July

Following the successful previous fairs in 2015 and 2014, Richard Barfoot's event returns to the Kind Edward School in Stratford Upon Avon.

As well as Amiga-related tables featuring Amiga OS4, Morph OS, AROS and, of course, classic machines, the event will be acting as the RISC OS User Group's summer event. Other stands will have all manner of Raspberry Pi and Micro:Bit related fun, as well as an Oculus Rift and stands from Makerspace and Hackerspace.

You can find out more about the event at www.recursioncomputerfair.co.uk or email info@recursioncomputerfair.co.uk.

Chris Huelsbeck Kickstarter

Following on from the successful Turrican Anthology Kickstarter a while back, Chris Huelsbeck is offering a new campaign to bring the orchestral arrangements of the music from *Turrican II* to a physical release on CD and vinyl.

However, it's not just orchestral arrangements, as Chris will be getting the new arrangements recorded by a full orchestra, making these recordings very special indeed.

The collector's edition of the double album will include two CDs and two LPs, and is limited to 1,000 units, though there are the options for download only or normal CD-only versions, and higher rewards including art prints.

You can find out more at goo.gl/U16zA1, but don't hang about, because the Kickstarter ends on Saturday 28th May at 22:59 BST!

Cinemaware Retro

I recently stumbled across Cinemaware's retro site, where it's offering very limited edition remakes of its games.

Two are currently available to pre-order, with *Wings Remastered Edition* for Morph OS, AROS x86 and Amiga OS 4.x (limited to 300 editions) and, possibly more intriguingly, *Defender Of The Crown – Extended Collector's Cut*, which includes the original game on CDTV, the CD32 *Defender Of The Crown II*, as well as the files for the original Amiga floppy, NES, Apple,

Amstrad CPC, Atari ST, CDi and MS-DOS versions.

Both come with a full-blown classic-style big box and extras, as detailed on their online shop.

Find out more at retro.cinemaware.com.



Shadow Of The Beast

By the time you read this, the reboot of *Shadow Of The Beast* on the PlayStation 4 will be available as a download from the PlayStation Store. The game has been produced by Heavy Spectrum and the team are all unabashed fans of the original game that came out for the Amiga 500 in 1989, and promptly made jaws drop due to the graphics and music, which were a revelation at the time.

The new game expands on the original concept, as you'd expect for a game from 2016, and it plays very well based on the alpha and beta versions I've played at events over the last 18 months. The most recent trailer showing the initial environment also screams nostalgia, as it's set in the grassland plain that everyone remembers from the first part of the original game and the rolling demo that was in almost every retailer in the second half of 1989!

Sony and Liverpool-based XDEV recently revealed that the unlocks for the new game include an emulated version of the Amiga original from 1989 (plus an infinity life unlock for it as well), along with the original music modules.

Look out for a review here soon!



Sven Harvey has been our Amiga specialist for over 16 years, drawing on his 25 years retailing computer and video games and even longer writing about them

Amiga



Ian McGurran is a professional IT analyst, a semi-professional writer and a pretty amateur electronic musician. He likes gadgetry and loves making gadgets do things they were never designed to do

Mobile

The Bigger Picture

Ian McGurran gets up close with the iPad Pro 12.9

When the iPad was announced in 2010, it was met with nearly as much confusion as acclaim: what would you want with a large iPhone? Subsequently, as it settled in and apps were released for it, the iPad began to make sense, even to those who may have been somewhat cynical at first (yes, including me), and now it's pretty much to tablets what Hoover is to vacuum cleaners. So when the iPad Pro 12.9 (as it's now called) was released at the end of 2015, many of the same points were made – "It's a bigger iPad. Why would you want a bigger iPad?" Yes, again that was me, and like the iPad before it, I'm prepared to have my mind changed, so does owning one do so?

Comparing the iPad Pro 12.9 to the original iPad is probably a little wide of the mark, given the change from iPhone to iPad was a whole new class of device with a whole new way of thinking. With the iPad Pro 12.9, the feeling is more akin to going from a 14" monitor to a 21" monitor – more of the same but so much easier to accommodate. In fact, you can probably sum up the advantage of the iPad Pro 12.9 in one word: space. Like when you first fire up that new, bigger monitor and revel in all that spare screen estate to play with, the feeling here is that there's more to see, and it's easier to look at. There's a very good reason for that: it's difficult to understate just how big the iPad Pro 12.9 is in the hand. Take, for example, your laptop screen, usually around 13", maybe 15", and put it a foot from your face. Big, isn't it? So is the iPad Pro, but surprisingly it's not cumbersome.

Browsing is definitely a highlight, along with reading



magazines, given when held in portrait the screen is much the same size as a regular magazine. In fact, most media consumption is great, given how good both the screen and especially the sound system are. A minor problem is you'll notice subpar video content looking particularly ropey when spread out bigger, but other than that it's a brilliant consumption unit, and it's marginally smaller than the portable TV I had as a kid!

Not only did I pick up the iPad Pro 12.9 out of professional curiosity, but also in equal part to aid media creation. It's no secret to regular readers of this column that I use the iOS platform regularly for audio creation, and I wanted to see just how close to the laptop experience I could get with the most powerful and capable iPad available. I wasn't to be disappointed, as audio on the iPad Pro 12.9 is a whole different level of power and capability. Soft synths such as the recently reviewed Moog Model 15 showed what the platform is capable of, while applications such as Cubasis and Gadget proved that if you wanted to, you could make full tracks. Not that you can't on say, the iPad Air 2, but it's the size and power that takes it up a notch, with things

easier to undertake with more space to move. Applications that controlled software mixing desks felt closer to the real deal too.

That's not to say that all is good in the world of the iPad Pro 12.9. Some six months after release, there are still many applications that don't take advantage of that extra screen size. Although the apps don't look as bad resized as iPhone apps did on iPads, it's still really disappointing to see. There are also too few apps specifically designed for the iPad Pro 12.9 that take advantage of the pencil, though the ones that do are still very good – Microsoft One Note being a particularly productive highlight. But this slow uptake, and the subsequent release of the 9.7" version with the same screen resolution as the standard iPad hopefully doesn't signal a shift in thinking.

I hoped to be surprised by the iPad Pro 12.9, beyond its enormous size, and I have been, pleasantly so. It's a bit like a big dog – nice and powerful and friendly, if a little unwieldy. It won't be to everyone's taste, it's really not one for being easily portable, and I'd hesitate to call it a laptop killer. But for some users it will be ideal, and it might even change the way they work.

Touchscreen Tunesmithies

You don't need to buy an expensive instrument to make music any more, writes Andrew Unsworth

Last week, I talked about making music on home computers and how the role of the computer has changed from being the host of a MIDI sequencer to being the backbone of music creation and performance. Indeed, today's powerful computer technology has made it possible to create hybrid instruments such as Native Instruments' Maschine range of music production tools and instruments (tinyurl.com/n24b798).

Even in the realm of more traditional instruments, computer technology beats at the heart of many keyboards and synthesisers. To give an example, the Korg Kronos workstation is powered by an Intel Atom processor, while even more modest instruments such as the Korg Krome (tinyurl.com/ocp4j6z) and Akai MPC Touch (tinyurl.com/hkqlu3e) have a touchscreen that allows users to interact with the device by manipulating graphics. This means that even if you want a stand-alone instrument, you can still benefit from the high-end sound generation and sequencing that computer technology makes possible.

What if you don't want to buy a regular instrument or something like the Native Instruments Maschine or an Akai MPC Touch? Well, chances are that you have a smartphone in your pocket or a tablet in your bag. These touchscreen devices lend themselves to making music magnificently, and there's a wealth of high-end apps available for both iOS and Android devices. The most notable examples are Image Line's FL Studio Mobile (tinyurl.com/hhc63eu), which



is the mobile analogue of Image Line's full-strength PC-based FL Studio music production software (tinyurl.com/otj5usn), and Native Instruments' iMaschine, which is a brilliant sketchpad app for creating beat-based music tracks (tinyurl.com/qef5xr2).

Tablet- and phone-based music production apps are not only great fun, they allow you to note down ideas when inspiration strikes, which could be on a train on the way into work, when shopping for clothes with your missus or when you roll in from a club at 3am, buzzing with enthusiasm and putting way too much faith in your already questionable 'skills'.

Another good thing about mobile apps is their immediacy and convenience, and the fact that they can run on modest hardware is all the better. What if you want to run music production software on your PC, though? What hardware do you need for that?

Thankfully, you don't need a fancy graphics card, so that cuts costs immediately. What you do need is a solid CPU and a good amount of RAM. Ableton, which makes the excellent Ableton Live 9 (www.ableton.com) music production software, recommends a multicore processor and 4GB of RAM. Steinberg, which produces the tasty Cubase 8.5 software (www.steinberg.net),

recommends a dual-core CPU and 8GB of RAM. I'd echo the 8GB of RAM whichever music production application you use, especially if you plan to use lots of sample-based software instruments. A few years ago, I ran a sample-based virtual instrument on a laptop with 3GB of RAM, and it didn't work at all well, so I'd pop at least 8GB of RAM in your PC if you plan on using it as a music production workstation.

I run Ableton Live 9 on a Windows tablet PC with a dual-core Core i7 mobile CPU and 8GB of RAM, and it works fine for my modest needs. I think that it's a good entry-level specification. If it were possible, I'd top up the RAM to 16GB, but to be honest that would be for comfort and overhead rather than any immediate need. However, the more virtual instruments you use, and samples, the more memory you'll need. Although Ableton Live 9 works fine for me on a dual-core i7, I'm a light user. If I was a power user, I'd want at least a quad-core i5 in a desktop music production PC. As software evolves, it becomes more CPU-intensive, so it's good to have a strong processor from the start.

Even if you have a modest or older setup, there'll be music production software out there for you. Indeed, there's never been a better time to tinkle the virtual ivories.



Andrew Unsworth has been writing about technology for several years, he's handy with a spanner and his handshaking skills are second to none

Hardware



Ryan Lambie has loved videogames since he first stared up in awe at a *Galaxian* arcade cabinet in his local chip shop. 28 years on, Ryan writes about gaming for Micro Mart. He's still addicted to chips and still useless at *Galaxian*

Gaming

Let It Go

Frozen synopsis: Disney Infinity, the toys-to-life competitor to Skylanders, has been cancelled. Disney is cutting its losses, and will be franchising out its game development from now on

This week, Ryan looks at the abrupt cancellation of Disney Infinity, plus Overwatch's anti-cheat tactics and huge open beta numbers...

Plug & Play

Empires rise and fall, fashions change and franchises come and go. So it is for the multi-million-dollar, *Skylanders*-inspired *Disney Infinity*, at least, as it heads the same way as the Etruscans and the snood. What's strange is that Disney's now-cancelled toys-to-life venture reportedly made around \$550m in its first 10 months of release in 2013. So what, we wonder, went wrong?

The news of *Disney Infinity*'s eventual demise came on May 10th. In an update from Disney Interactive boss John Blackburn, it was announced that *Disney Infinity 4.0*, the latest release of the game once scheduled for 2017, was now effectively cancelled. As for the toys themselves, the line will end in June, with three figures based on Disney's movie *Alice Through The Looking Glass* and a play set modelled after Pixar's *Finding Dory* being the last to carry the Infinity brand.

For Disney, the axing of *Infinity* represents a considerable cutting of its losses; millions has clearly been spent on development (around \$300m, if reports are correct), manufacturing and marketing, and that's on top of the \$147m the company has

already admitted it will lose from closing the *Infinity* line.

The shockwaves are already being felt far beyond Disney, however. Avalanche Software, a studio set up in 1995 – and which has been making games for Disney for the last decade – is to close with the loss of around 300 jobs. It remains to be seen whether other studios who also created software for *Infinity* will also be affected; Studio Gobo and Ninja Theory were both teams who worked on the franchise in one capacity or another.

What's doubly surprising about the game's demise is that there appeared to be firm longterm plans for it as recently as March of this year. "The company has been completely behind *Disney Infinity*," Disney Interactive told *Polygon* back then. "If you look at all of the creative content coming out this year, you can see they are still proud and still 100% behind us."

Sure, *Disney Infinity 4.0*, once scheduled for release in 2016, was also pushed back to 2017, but with the game widely praised and all kinds of new toy lines and missions planned for it – including figures and missions based on *Star Wars Episode VIII* and *Cars 3* – its future looked certain.

Ultimately, *Infinity*'s fate seems to have come from a pincer movement of events. One is competition from rival toys-to-life franchises like *Lego Dimensions* and Nintendo's Amiibo range. Another, incredibly, appears to be Disney's own over-manufacturing. According to sources quoted by *Kotaku*, Disney simply made too many toys in response to an initial burst of demand; its over-zealousness was such that two million Hulk figures were made, only half of which sold. All of this caused Disney's higher-ups to lose confidence in what was once considered a potential billion-plus franchise – and thus, the hammer fell.

Even if you're not into *Infinity* yourself, its demise isn't entirely insignificant; Disney has also announced that it's pulling out of making PC and console games altogether, with its licences now being farmed out to other companies, such as EA. Disney may own some of the most profitable names in modern pop culture, from Mickey Mouse to Marvel to Star Wars, but its forays into an entire medium are, for now, ancient history.



▲ Players caught cheating in *Overwatch* will receive a lifetime ban from their first offence, *Blizzard* has clarified. Leave the bots at home, kids

Online

Cheats never prosper, the saying goes, but in the realm of online gaming, they're tough to root out. Nevertheless, *Blizzard* is determined to stamp out the use of hacks, bots or other sneaky uses of code in *Overwatch*, its new multiplayer shooter, and has a drastic measure lined up for anybody it catches. "If a player is found to be cheating," the game's community manager said in a May update, "that player will be permanently banned from the game."

To help root out the cheaters, *Blizzard* is encouraging users to report players they suspect

might be using third-party software or other naughty shortcuts to get ahead in the game. That the company is taking hacks and bots so seriously isn't necessarily surprising, but it's certainly a sign of how seriously it's taking its first foray into the shooter genre. *Blizzard* says it's already tweaked *Overwatch* and removed cheating players from the game's open beta phase – a bout of testing which, according to the company's own figures, attracted an unexpectedly fevered response.

Overwatch's beta hooked in around 9.7 million players across five days, which, to

use a highly technical term, is ruddy huge. To put that figure into perspective, compare it to *Ubisoft's The Division*, which managed to set a record for a new property's beta with 6.4m users in February this year.

Since then, *Ubisoft's* open-world pandemic-themed RPG-blaster hybrid has managed to rack up a startling 9.5m registered users – making it one of the most successful non-sequel games ever launched. With *Overwatch* generating so much interest in its own open beta, could it be that it'll break its own records in the coming weeks and months? As we've already seen, there's no shortage of arena shooters vying for our attention either now or on the horizon – not least *Gearbox's* well-received *Battleborn*.

However, if history's taught us anything, it's that we probably shouldn't bet against *Blizzard* taking a massive chunk of the market. For years, *World Of Warcraft* ruled the MMORPG roost, and it's just possible that *Overwatch* will do the same for the arena shooter genre.

Incoming

Later this year, *EA* goes back to basics – and back in time – for *Battlefield 1*, its shooter sequel set in the trenches, skies and deserts of the First World War. However, just because *EA's* opted for an old-school setting, doesn't mean it will forgo the kinds of new-fangled revenue streams modern games use – namely, map packs and micro-transactions. We know this because of a recent earnings announcement, in which company boss *Andrew Wilson* used words such as "Vector" and "extra monetisation opportunity."

In English: *Battlefield 1* will introduce paid-for map packs and smaller purchasable items (such as weapon skins) that won't turn the game into a 'pay-to-win' quagmire. Whether they really will "enhance the player experience", as he maintains, remains to be seen. *EA* appears to have goodwill behind it, though; *Battlefield 1's* announcement trailer is now the most 'liked' video in *YouTube's* history. We're guessing *Activision's* standing on the sidelines somewhere, making gestures in *EA's* general direction.



▲ Map packs and microtransactions will "enhance the player experience" in *Battlefield 1*, *EA* has announced, to the cheers of gamers everywhere...

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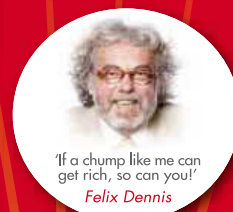
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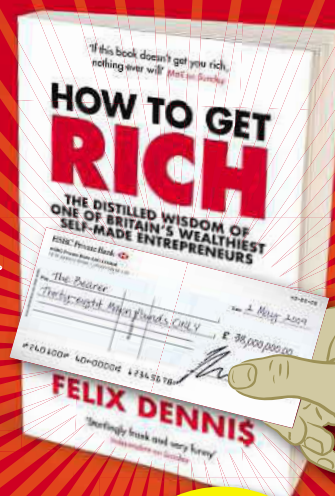
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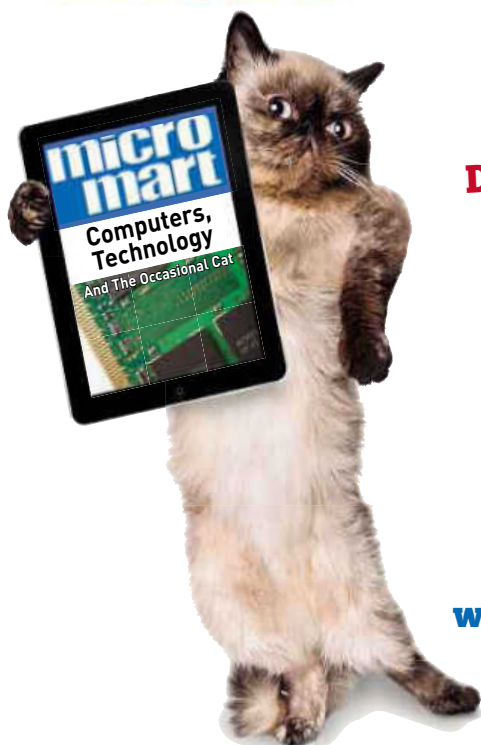
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It's based on an IPM87 motherboard and he wants to put on an Intel i7-4790K processor and an NVidia Geforce GTX graphics card and 8GB of fast DDR3 memory.

He would install Windows 10, 64-bit. The trouble is he's on a tight budget and can't afford much more. Would the motherboard take it?

Your advice would be most helpful.

Arthur

According to the official specification of the IPM87, it should be happy to support the upgrades you're planning. The board can handle the Intel i7 CPU, as well as the graphics card. It'll hold up to 16GB of RAM, providing you're using a 64-bit system.

So, if you were going to upgrade, you should have no problems with your planned specification changes. I'd just advise you make sure you're running the latest firmware that's

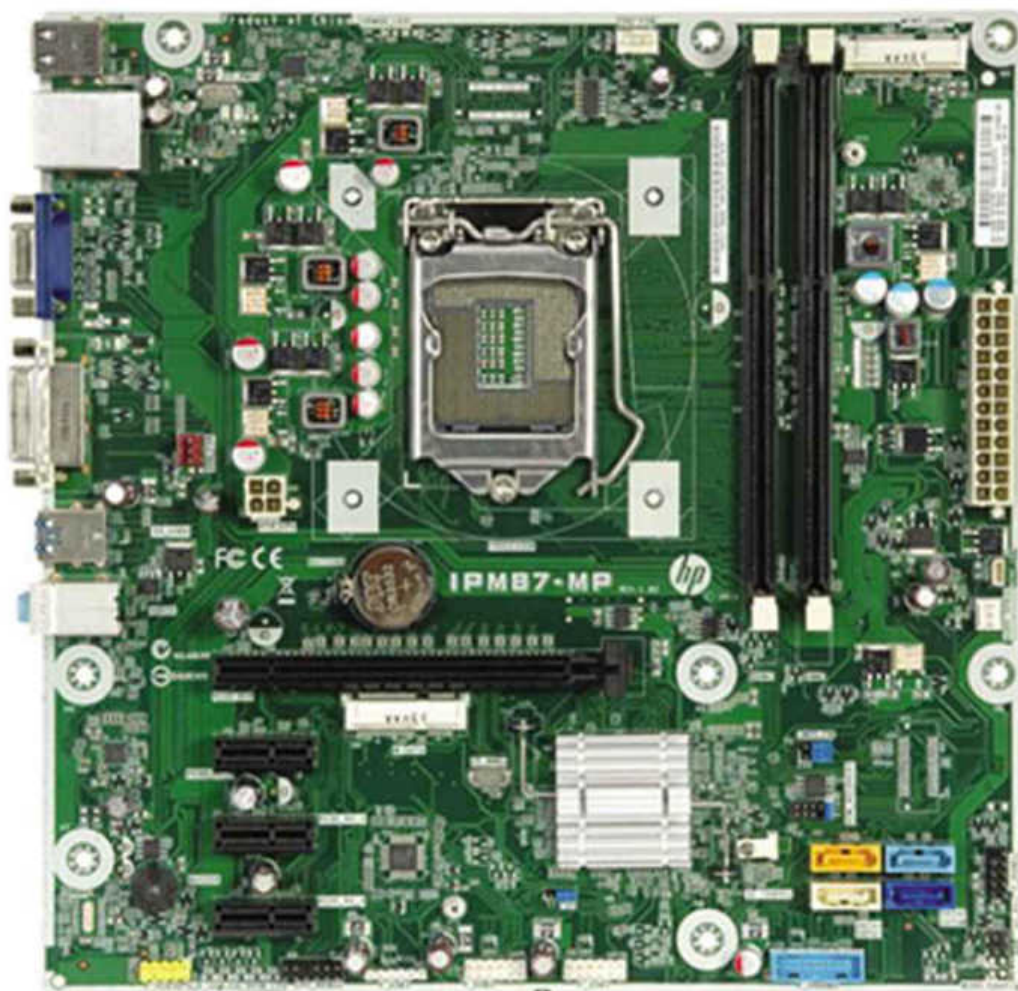
available for the board, as this will ensure you're starting from the best possible platform.

However, I would also say that if gaming is a major focus of the system, as you say, it may be a good idea to think about upgrading the motherboard at some point. While the board you have is fine for what you require,

**“ Its expansion
capabilities aren't
that great ”**

it's not really – and never will be – designed for gaming specifically. As such its expansion capabilities aren't that great, and could be limiting if your grandson intended to move on to high-end gaming at some point. For now, though, you should be okay.

▼ **HP and Compaq systems aren't really known as gaming machines, but some can handle decent gaming hardware**



TV Downloads

I was hoping you could clear something up for me, something that I've never really been able to clarify. I was under the impressions that downloading a TV show, such as *Game of Thrones* or *Daredevil* was not illegal. After all, it's on TV, and people used to always record shows to VHS tape, and still do thanks to PVR devices.

I've been told that this isn't correct, and that downloading TV shows is actually illegal. Now, I can understand this when talking about movies and music, but as I pay for my TV license and subscribe to cable TV, I just don't understand why it applies to TV.

Can you explain?

Graham

The reason this subject always causes so much confusion is down to the constant legal grey area it resides in, and because the legal approach to it is so different around the world, with laws and proposals always changing. It's a perfect example of a legal minefield, that's for sure.

To put it as simply as possible, yes, downloading TV shows is illegal. On the most basic level, downloading any copyrighted material without the express permissions of the copyright holder is wrong, regardless of the content, be it TV, movies, music, or anything else. If you normally

have to pay for it, whether it's a purchase, subscription, or on-off movie ticket, if money is supposed to be involved, and you bypass this to get it free, and it's not through official channels, then it's wrong.

Of course, the argument then comes in of TV licenses, the fact we used to tape things on VHS all the time, we record music from the radio, and so on, and so forth. This is irrelevant. In actual fact, all those years of taping TV shows and movies on TV, or recording music from the radio were also illegal. Sure, it was rarely, if ever acted on in a legal manner, but it was still considered stealing. If you PVR a show from cable these days, this isn't considered illegal, as you're paying for the cable service, so a fee is involved. There's also advertising revenue. Downloaded content has no such revenue generation for the copyright holder.

The major problem copyright holders have with regard to the whole situation is the scale of downloading. Unless you're planning to distribute the media to others on a large scale, it's not considered a crime worthy of intervention by the authorities and is more of a civil case. This means the onus is on the copyright holder to pursue downloaders. This would, obviously, require a huge cost and a lot of work, something that companies just can't justify. If you then add into the mix the common form of downloading that is Bittorrent, in which people only share small

fragments of data, not the whole product, and it becomes very hard to enforce, which is why the torrent site operators are often the target instead.

Until there's a solid, enforceable law behind downloading, one that's easily explained and determined, the situation is unlikely to change, with the grey obscuring any efforts. Even big, high-profile cases that have been seen as successful, such as the infamous Napster Vs Metallica case back in 2000, or the various arrests and shutdowns of sites like The Pirate Bay have had little to no effect on the future of downloading and file sharing. The technology and people involved simply adapt and move on.

Laws are always changing, and as I mentioned earlier, the situation may be very different depending on where you live, so always be careful and download content with care if you're concerned. There's no shortage of legitimate streaming and download services such as Netflix and Spotify around, all of which are perfectly legal and safe.

▼ **If the copyright holder doesn't give permissions, it's generally accepted as illegal to download media**



PS4 Upgrade

I know this isn't technically a PC question, and so isn't the usual topic *Micro Mart* looks at, but I was hoping you could help anyway, as it does involve PC hardware.

I have a PlayStation 4, which came with a 500GB hard disk. This quickly filled up, and I find myself at a point where I'm having to delete content all the time to fit new games on. It's a massive pain, and I need to find a way around it. I understand Sony made it possible to upgrade a PS4's hard disk for a larger volume, and this is what I want to do. I've heard that you need a specific drive for the system though, and not just any old drive will do. I have a few spare hard disks, including a 1TB internal drive in one of my older PCs. I was thinking of using this, but I see conflicting information online about which drives are recommended.

Could you clear this up and let me know what I should be looking for?

Peter

The PlayStation 4 does, indeed, support hard drive upgrades, and you do have to use specific types of drive. Specifically, you need to use 2.5" drives, the kind you'll usually find in laptops.

If your 1TB internal PC drive is a standard, 3.5" unit, you're out of luck, I'm afraid. As well as the 2.5" form, the unit also has to be no more than 9.5mm thick, or it won't fit into the PS4's hard drive enclosure.

As for other specifications you'll need to know about: it will need to be SATA II, spin at at least 5400RPM, and larger than 160GB. As you're upgrading for more space over the installed 500GB model, the size of the drive won't be an issue.

There are a lot of suitable drives around for the PS4, with a lot of users swearing by Seagate's SSHDs (solid state hybrid drives), or Momentus 2TB HDD. Samsung's 2TB M9T is another popular choice, as are Western Digital's Slim range. You can even find specific PS4

bundles on sites like Amazon that come with a drive, screwdriver and USB stick. This set the gives you everything you need to upgrade.

▼ **You can buy PS4 upgrade kits that include all you need to increase your console's storage**



ASK JASON



Meet Jason D'Allison, a veteran of Micro Mart's panel of experts. He's here to help with any technical questions, including anything to do with tablets or smartphones, as well as PCs

Send your questions to:
Jason D'Allison
Micro Mart
Dennis Publishing
30 Cleveland Street
London
W1T 4JD

Contact Jason by email at:
jason@micromart.co.uk

While we try to cover as many questions as we can, we regret that Jason cannot answer your questions personally, but he'll cover as many as he possibly can each week. Please ask one question per letter and remember to include the full specification of your computer, including its operating system.

Jason

Recovery Position

I've just upgraded my PC from Windows 7 to Windows 10. The OS and programs are installed on a 120GB SSD (my data's on a spinner), and under Windows 7 this was all given to drive C: except for the obligatory 100MB system partition at the disk's start. Under Windows 10, though, there's now also a recovery partition, at the disk's end. This is 11GB, but it appears to be empty. Can it be deleted without messing the PC up? I could do with reclaiming the space.

Susan, Zen Internet

The recovery partition exists so that you can click Settings > 'Update & security' > Recovery and reset your PC to day one. On a clean install, the partition is typically only 450MB and not worth worrying about. On an upgraded PC, however, it can be much larger (as you've found), as it'll contain all that's needed for a roll-back to the previous OS (allowed within thirty days of the upgrade). It won't be empty, even if it looks like it.

Can you delete it? Yes. Note that I'm referring to the partition that appears (usually!) *after* C:.

On a PC that's been upgraded from Windows 8 or 8.1, there may be two or even more such partitions.* All but the latest are redundant. Of course, any system partitions appearing *before* C: should be left well alone. There'll typically be two of them on a Windows 10 PC with a GPT-configured disk rather than a traditional MBR-configured disk. You probably know all this already, Susan.

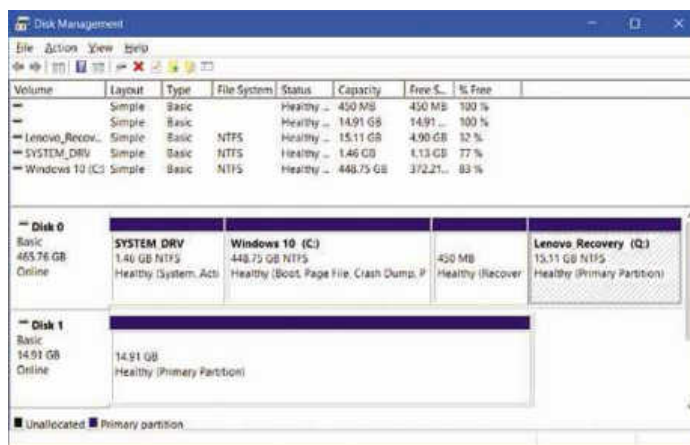
If you do want to delete your recovery partition, you'll need third-party software. Windows won't let you do it with its own tools. Maybe try the free edition of Paragon Partition Manager (goo.gl/1kv3hZ) or EaseUS Partition Master (goo.gl/d0J4H7) – others are also available.

Before that, though, be sure to have your own recovery

plan in place. By far the easiest way to achieve that is to use Microsoft's media-creation tool to download the relevant Windows 10 ISO and set up a bootable USB stick. Head to goo.gl/MZJmOj to get started with that.

* In addition, there may be a recovery partition created by the PC's manufacturer, containing the original OS and all the associated bloatware. This can also be deleted if it's definitely not required. Confusingly, it'll usually be located before C:, not after, so care is needed not to delete a system partition by mistake.

▼ Can any of these be safely deleted?



Feedback Farce

I sold my old netbook on eBay a few weeks ago and yesterday I received negative feedback. The buyer hasn't contacted me at all, and the feedback states the item wasn't received. This isn't true, as I sent it via Special Delivery and it was signed for. I've contacted the buyer and not had a response. I'm sure he or she has left the feedback for the wrong seller or is just being plain nasty for some reason.

Obviously I want eBay to remove the feedback – my account was previously at 100%, and it's now dropped to 96.5% – but it's proving very hard to get anywhere by phone or email. I'd like to open an online chat session and explain the situation in depth with

an advisor, but I can't see any link for that. If I remember correctly, you've mentioned this before and provided a solution. Help!

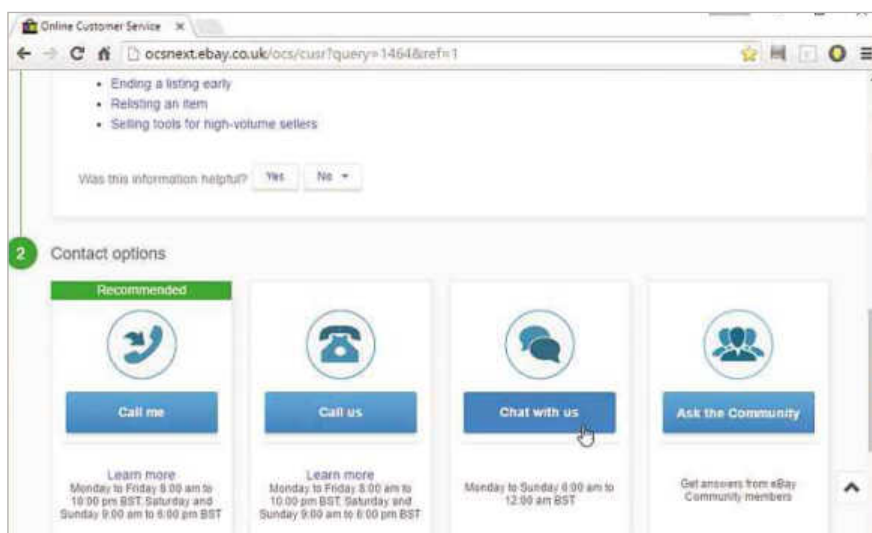
A Emms, Gmail

I think you're right: I touched on this a while back. It's still not straightforward to open an eBay chat session, and I can only assume this is deliberate. If the service were advertised front-and-centre, I expect it'd be swamped. That's not to say a high percentage of eBay transactions go sour, though many do. A company handling hundreds of millions of transactions per year is bound to see huge numbers of complaints, even if 99.9% of the time things go smoothly. Sometimes it does

feel that eBay would rather not hear about these complaints, however.

Anyway, what you're after is this direct link: goo.gl/DBT5w0. Scroll down the page to the icons and click 'Chat with us'. A new window will appear. Enter the relevant item number and a brief description of your problem – just a few words – and click 'Start chat'. You shouldn't have to wait more than a minute or so before you're connected to Lucky, Marigold, Candy, or some other advisor with a made-up name.

► Often the best way to sort out problems on eBay is to chat with an advisor online, but that can be easier said than done...



New Light Through Old Windows

One of my friends cleared out his attic recently and asked if I wanted an old PC he was going to throw out. Naturally, it's now in my spare room. It switches on and appears to work okay, but it's running Windows 98. No! Save me! Could it be upgraded to Windows XP – I have a spare licence – or does it just not have the power? The specs are as follows (according to my friend).

CPU: 800MHz Athlon (Thunderbird)

Motherboard: Asus K7V (Slot A)

RAM: 768MB PC133 (1 × 512MB, 1 × 256MB)

GPU: 64MB GeForce 256 DDR

HDD: 15.3GB IDE

I know XP is dead and also dangerous, but I doubt I'll go online with this PC. I'm hoping to be able to drop MAME onto it and use it for old arcade games. Should I maybe increase the RAM? Or should I just abandon the whole idea?

Seb, Gmail

My word. We're winding the clock back here, Seb. Some years have passed since I last clapped eyes on a Slot A system. I'll wager that some readers of Micro Mart have never seen one at all (I'm officially a dinosaur). Should you abandon your idea? Certainly not. Have fun, my friend.

Can the PC run Windows XP? Absolutely. Windows XP launched in 2001, and your CPU, motherboard, and GPU all launched the year before. A perfect marriage. Don't bother upgrading the RAM. The

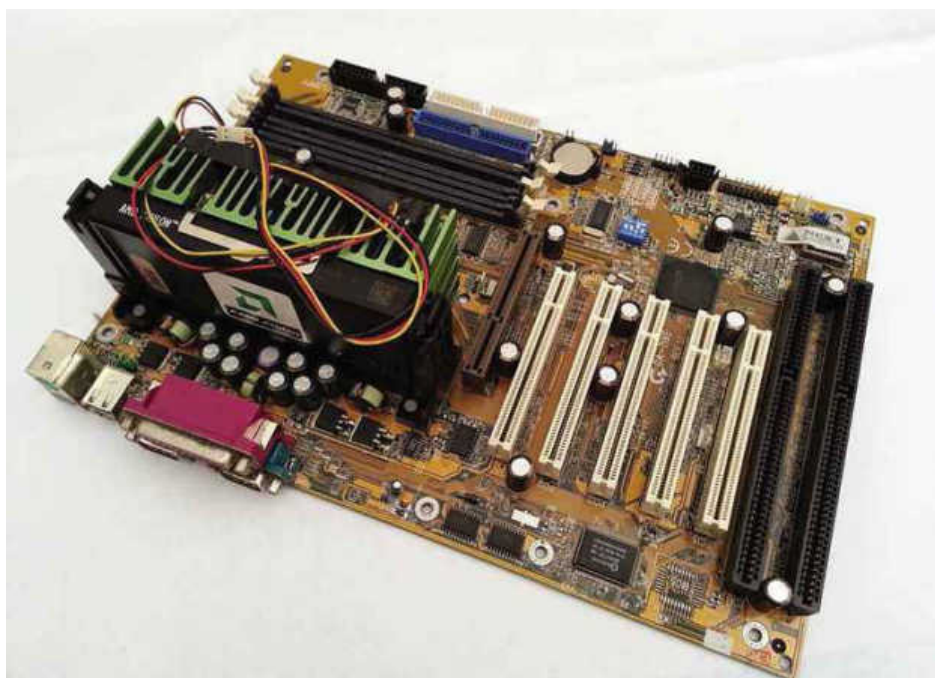
motherboard can handle 3 × 512MB, but 768MB is fine for an XP rig of this vintage. The same for the GeForce 256 DDR. In a modern setting, it wouldn't knock the skin off a rice pudding, but it's well suited to playing classic arcade games via MAME. Back in 2000 (or 1999 for the non-DDR variant), it was a game-changer.

The main potential issue is driver support. XP should install drivers for most of your hardware automatically, especially if your setup CD includes at least SP1, but I wouldn't be surprised if it stumbles on, say, the integrated sound card. But no worries. It's the Cirrus Logic CS4299, and Dell still has an XP driver online: goo.gl/3Qe5ro. You'll

also need a driver for the GeForce, and Nvidia's also playing fair: goo.gl/gtQ69s. If there are any add-on cards – for Ethernet or Wi-Fi, perhaps – a few minutes on Google should see you right.

PS – Make sure all the fans are working properly. Maybe add a case fan if there isn't one already. The PC is a museum exhibit and needs to be looked after to keep it going. One blown capacitor and it could be game over.

▼ **AMD's first stab at a CPU interface was Slot A (the more common Socket A followed a year later, in 2001)**



Crowdfunding Corner

New meets old with this week's pair of projects – one looking to the future of technology, and one looking way, way into its past

Marble

Following the lead of Apple, high-end laptops are starting to strip away extraneous ports and rely on a sole USB-C connection. That means it's becoming more and more necessary to have access to some sort of hub if you want to keep using external hardware with your laptop. Furthermore, if you have got a USB-C port on your laptop, it's simply easier to have just one device to plug in and remove if you want to move it around.

The Marble USB docking & charging station incorporates a pair of USB 3.0 ports, two USB-C ports and a microSD card reader. There's also a 60-watt AC adaptor that can charge your device (where supported) and deliver power to smartphones and tablets plugged into the USB ports, and both HDMI and Mini DisplayPort adaptors for your monitor. It even works as a stand-alone charge station while not plugged into a PC.

The project has already smashed its initial \$50,000 target with several weeks to go, and you're still able to pick up a Marble charger for as little as \$109 (£75), which is 10% off the projected retail price. Higher tiers include extra accessories and multiple units at a similar discount, with the entire package due for release in September 2016.

URL: kck.st/1srj0cQ

Funding Ends: Sunday, June 12th 2016

Rebuild Eric: The UK's First Robot

In 1928, when the word 'robot' had only been around for a few years, yet the Society of Model Engineers' annual exhibition was opened with a speech from Eric, the UK's first ever robot. The mechanical man weighed just over 45kg and had 'armour-plated chest, legs and arms' made of Aluminium. Eric toured the globe with his makers before mysteriously disappearing – no-one is quite sure where to.

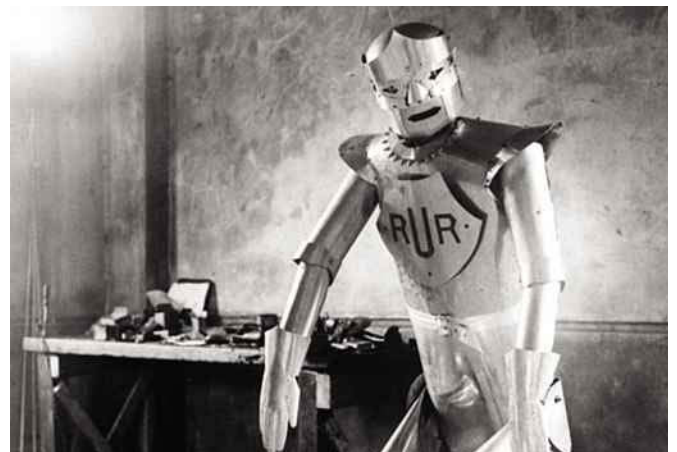
Now, the Science Museum is stepping in with a plan to rebuild Eric the robot as faithfully as possible by studying images and other archive materials. The Kickstarter team calculate that it will take three months for roboticist Giles Walker to build, should the project meet its crowdfunding goal.

10 days in, the project is a third of the way there, with 30 days left. Backers can pledge £10 to receive a short film about the robot's construction, £20 for a t-shirt or tote bag, and £30 for a miniature laser-cut steel model of Eric. Rewards will ship in October 2016, after which you'll be able to visit Eric at the Robots exhibition which takes place at London's Science Museum between February and September 2017.

URL: kck.st/1WCEd0H

Funding Ends: Thursday, June 16th 2016

Charge Your Many Devices Simultaneously



Disclaimer: Images shown may be prototypes and Micro Mart does not formally endorse or guarantee any of the projects listed. Back them at your own risk!

App Of The Week

Eva – The real video social network

Social networking is everywhere these days, and here's one to look into

Social media is big. Mind bogglingly big. In fact it's estimated that over two billion people currently use some form of social media. That's at least one in every four of us worldwide. And it's growing too, at a rate of around two to three hundred million users per year.

We now have the ability to share virtually every aspect of our lives as an

image, video or just a string of text. Whether sharing all of it is a good thing or not is up to you to decide, but you can't knock the potential for bringing friends and family together and sharing life's experiences at the instant they happen.

It's little wonder that UK developer Forbidden Technologies has released the latest in social media networks.

Socially Eva After

Eva is a new video social network, which uses Forbidden Technologies' industry leading cloud video platform, Forscene, to allow the user to watch, create, share and engage in content from around the globe.

Using the patented Evafeed, you can scan through the collective content of thousands of users based on your own interests, location, and the friends and acquaintances you decide to follow. All you need to do is simply launch the app and the feed will start playing using your pre-defined preferences.

You can shoot your own footage and upload it to the Eva cloud using your profile, then much like a YouTube video you can share it with friends and either comment on others or allows others to comment on your video. You can also include tags, include friends and, through the video platform, express whatever ideas or world views you have based on the footage you've taken.

Described as the YouTube for the Instagram generation, Eva hopes to become the world's leading social video sharing platform. And with more features due to be made available soon, such as a 36,000-strong filter pack and trim

Features At A Glance

- Available to download free for iOS and Android.
- Developed by UK-based Forbidden Technologies plc, developer of the world's most powerful professional cloud video editor: Forscene.
- New video social network allows people to shoot and share videos in full-screen portrait.
- 'Evafeed' – public stream of content. Relevant content played immediately upon opening the app, requiring zero interaction.
- Totally cloud-based – no need to worry about your smartphone's memory.
- Incredible user experience that is slick, simple and intuitive.

feature, it may well be able to nab a good share of the social media market space.

The Growing Network

A lot of thought and focus has gone into making Eva a balanced, great-looking app. But it has an uphill battle ahead if it's to make its mark as the go-to app for sharing video content.

However, based on what we've seen so far, the future is looking bright for this expressive app. With more content being added by the second and more members joining the fold, expect to see Eva making the headlines and becoming as big as the developer hopes in the coming months.

If you're interested, you can find out more on the iTunes or Play, or via the Eva site at www.Eva.co. [mm](#)



▲ Eva has a lot going for it. Become a part of it early and watch it grow

Logging Off

It's been nearly three years since I built my current Haswell based PC, so I've been toying with building a new system using various parts I've got clogging up my office. I bought a Skylake processor to review motherboards, but they seem to be drying up these days. Combining that with a Z170 chipset motherboard I swapped, some DDR4 and a spare SSD, I'm most of the way there already. Throw in a PSU, a case that I put to one side months back, transfer my existing video cards and I'm ready to rock – almost.

It does leave for consideration the gnarly subject of operating systems these days. With the countdown to the end of free Windows 10 upgrades on the horizon I've been considering what might be the best thing to do. It's not an easy choice.

I've seen a few American tech people saying that what they'd do is install Windows 7, then upgrade to 10 (activating it), and then roll back to 7. The theory – and it's only that – is that once a PC is activated for 10 it can be upgraded to that release at any time in the future. That would be great, if it *is* actually true. The belt-and-braces approach to that would be to make an image of both activated Windows 7 and Windows 10, and keep those safe.

However, part of me really wonders why I'm keeping my options so open, because at this time there isn't anything I'm doing on the PC that I can't do with Windows 7. And, given my three year cycle of new computers, Windows 7 will still be getting updates by the time I come to replace this new one.

If you're wondering why I don't feel I need a Windows 10 PC in order to write about that technology, I have another PC next to my desk with that on it. I regularly update that, mostly out of a morbid curiosity regarding what Microsoft can mess up next. Also, I have a laptop that came with Windows 8.1 pre-installed on it, so upgrading that to 10 was a no-brainer.

What's a bit odd about the desktop Windows 10 machine is that I built that about nine months ago using the Pentium G3258 anniversary CPU, and just put Windows 10 RTM on it initially. Since then it's magically



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become activated, when it has never had a valid license go within 10ft of it.

There will be some of you reading this wondering why I don't really grasp the nettle and put Mint or Ubuntu on this new equipment and wave sayonara to Windows altogether. I would, but I've still a few critical apps that rely on it, frustratingly.

If that wasn't the case I'd have probably moved to using Chrome a while back, through either a Chromebook or Chromebox. Because, when it comes down to it, with the exception of games most of the things I do with my PC are generally beneath it.

That's the fine irony here. if I didn't have all these spare parts then I couldn't justify the expense of buying them just to build a system that will probably be massively underutilised. It's a sobering thought; as is that this might well be the very last Windows PC that I build, should things not change drastically in the future.

Mark Pickavance

LAST WEEK'S CROSSWORD

Across: 7 Quadraphonics, 8 Reverb, 9 Fliers, 10 Krytron, 12 Sonde, 14 Gecko, 16 Roy Nutt, 19 Esprit, 20 Revamp, 22 Sacerdotalism.

Down: 1 Huge, 2 Advent, 3 MacBook, 4 Shift, 5 Indigo, 6 Accredited, 11 Rheostat, 13 Worrits, 15 Kernel, 17 Novell, 18 Study, 21 Mesh.

DISCLAIMER

The views expressed by contributors are not necessarily those of the publishers. Every care is taken to ensure that the contents of the magazine are accurate but the publishers cannot accept responsibility for errors. While reasonable care is taken when accepting advertisements, the publishers cannot accept any responsibility for any resulting unsatisfactory transactions. If you've heard any massive expulsions of profanity drifting in on a light breeze this week, it may well have been our fault. We apologise profusely, but it's been one of those weeks where the fates have decreed we must deal with multiple automated call systems in the act of carrying out our day-to-day business. They don't

get any better, do they? Seriously, in a world where we can ask our smartphone to perform fairly complicated tasks using verbal commands, or get it to answer quite a lot of the niggling queries we have [okay Google, who starred in *May To December*?], you'd think someone could design a call waiting system that didn't leave you questioning the reality of existence, or whether you were actually trapped in someone else's Kafkaesque nightmare. Maybe a good use of Facebook, Google and Apple's AI chops would be to create a bot that could chat to you while you're on hold, play you some music that you actually like, or even – though this is a push, we accept – sound convincing as it tells you that your call is important to it.

THIS WEEK'S CROSSWORD

Across

7 A physical concept that certain properties occur only in discrete amounts. (7,6)

8 Short messages posted on Twitter. (6)

9 A designated limit beyond which something cannot function or must be terminated. (6)

10 Where your web browser keeps track of the sites you've visited. (7)

12 A communication system based on broadcasting electromagnetic waves. (5)

14 In mathematics order theory, a partially ordered set. (Acronym) (5)

16 The most valuable property in the Monopoly board game. (7)

19 A source or repository of data usually read or written sequentially over time. (6)

20 Have a light hearted disagreement over something. (6)

22 A line or surface on a diagram connecting points representing those in the interior of the earth having the same temperature. (13)

Down

1 Amphibious transport vehicle, especially as used by the Allies during the Second World War. (4)

2 Put money into financial schemes,

shares, property, or a commercial venture with the expectation of achieving a profit. (6)

3 Very luminous astronomical objects observable to very high redshift ; thought to be associated with an active galactic nuclei where material merges into a supermassive black hole. (7)

4 In computing a set of storage locations which store data in such a way that the most recently stored item is the first to be retrieved. (5)

5 Nickname often given locally to machines that are abnormally large. (6)

6 Writing or drawings scribbled, scratched, or sprayed illicitly on a wall or other surface in a public place. (8)

11 A means of determining a material's strength by striking a notched specimen until broken by a blow from a pendulum. (4,4)

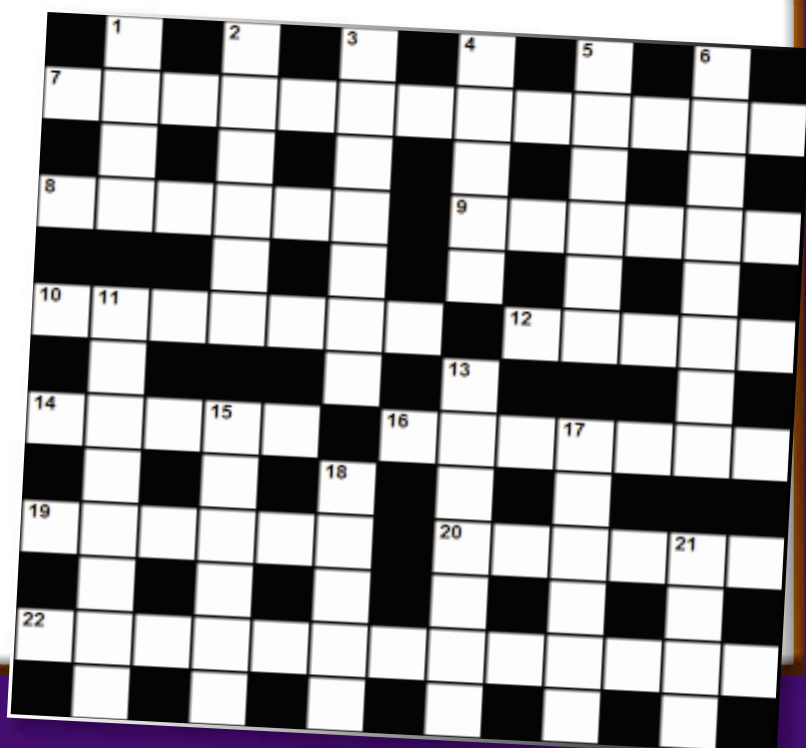
13 Distinctive and stylish elegance. (7)

15 A scalar physical quantity that describes the amount of work that can be performed by a force. (6)

17 One of the elements that collectively form a system of numeration. (6)

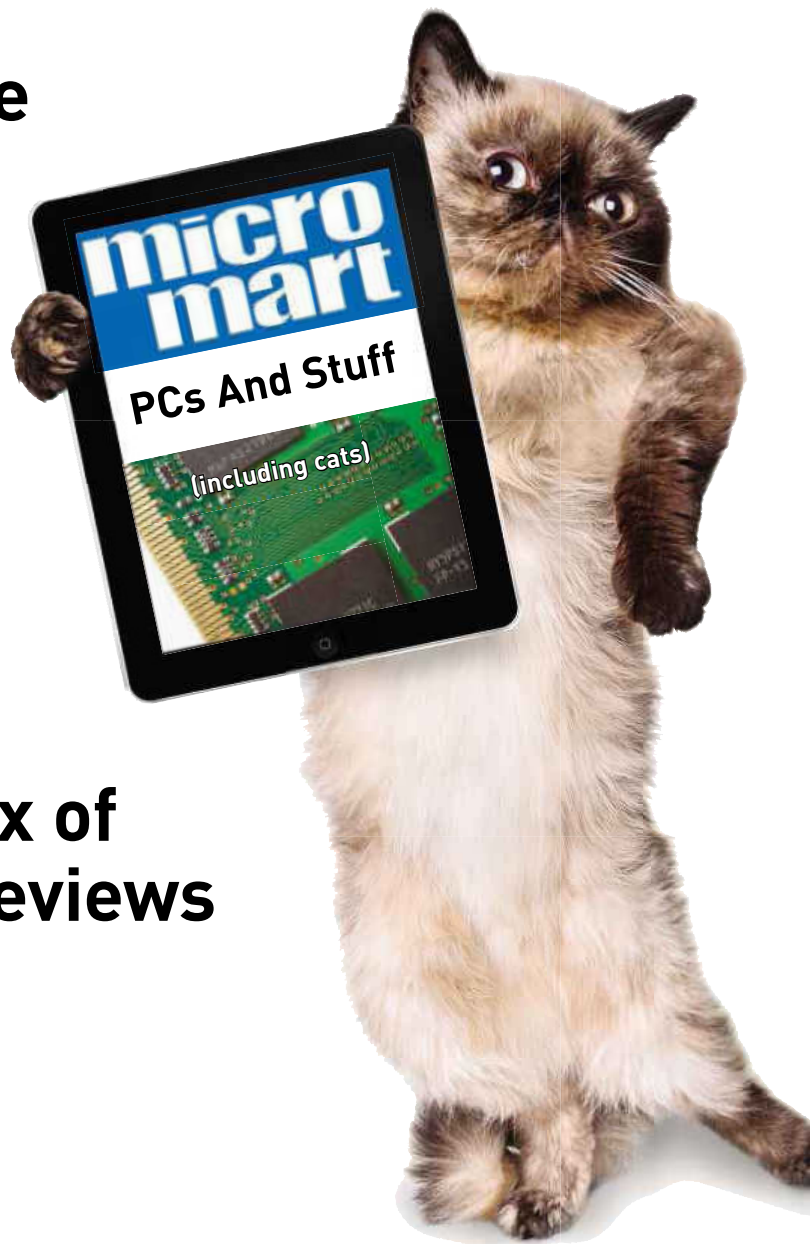
18 A Malay stew typically made with fish. (5)

21 An imperfection in an object or machine. (4)



In Next Week's Micro Mart*

- How to create automated backups so you never lose a file again
- Could someone be tracking your phone? And what can you do about it if they are?
- The dark side of online nostalgia
- Plus the usual mix of news, features, reviews and advice



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Features	OverDrive, Black Tuner, Blue Light Reducer, Predefined and Custom Gaming Modes
Inputs	DisplayPort, HDMI, DVI
Audio	speakers and headphone connector
Height adjustment	13 cm



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